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Analysing the Sources of Wood Supply to Sustain Domestic Wood Demand: A Case Study of Selected Wood Markets in Kumasi-Ghana

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"ANALYSING THE SOURCES OF WOOD SUPPLY TO SUSTAIN DOMESTIC WOOD DEMAND: A CASE STUDY OF SELECTED WOOD MARKETS IN KUMASI-GHANA"

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DECLARATION IN LIEU OF OATH

This is to confirm my Master's Thesis was independently composed/authored by myself, using solely the referred sources.

I additionally assert that this Thesis has not been part of another examination process.

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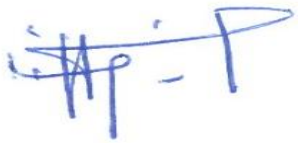

Signature

DEDICATION

I dedicated this thesis to my dearest husband, Adu-Sarpong Emmanuel and my adorable kids, Adu-Sarpong Oheneba Amponsah, Adu-Sarpong Owuratutu and Adu-Sarpong Nhyiraba Baabo. Your countless support has made this possible.

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LIST OF ABBREVIATIONS

AAC	-	Annual Allowable Cut
AGI	-	Association of Ghana Industries
ARM	-	Assistant Regional Manager
AM	-	Artisanal Milling
AM	-	Area Manager
C&S	-	Common & Select
CRIG	-	Council of Scientific and Industrial Research
ECOWAS	-	Economic Community of West African State
EFI	-	European Forest Institute
ERP	-	Economic Recurring Programme
EU	-	European Union
FAO	-	Food and Agriculture Organisation
FAS	-	Fair, Average and Select
FC	-	Forestry Commission
FLEGT	-	Forest Law Enforcement Governed Trade
FORIG	-	Forestry Research Institute of Ghana
FSC	-	Forest Stewardship Council
FSD	-	Forrest Service Division
GDP	-	Gross Domestic Product
GEF	-	Global Environmental Fund
GFTN	-	Global Forest Trade Network
ITTA	-	International Tropical Timber Agreement
ITTO	-	International Tropical Timber Organisation
KWC	-	Kumasi Wood Cluster
LAS	-	Legality Assurance System
LI	-	Legislative Instrument
LKS	-	lesser known species
LUS	-	lesser used species
M3	-	Cubic Meter
MLNR	-	Ministry of Lands and Natural Resources
NDC	-	National Democratic Congress
NGO	-	Non-Governmental Organisation
NPP	-	New Patriotic Party
REDD+	-	Reduced Emission for Deforestation and Degradation

RWE	-	Round Wood Equivalent
SFM	-	Sustainable Forest Management
SPSS	-	Statistical Package for Social Scientist
SPWD	-	Secondary Process Wood Product
SRA	-	Social Responsibility Agreement
TBI	-	Tropenbos International Ghana
TIDD	-	Timber Industry Development Division
TUP	-	Timber Utilisation Permit
TVD	-	Timber Validation Department
VAT	-	Value Added Tax
VPA	-	Voluntary Partnership Agreement
WSA	-	Wood Sellers Association
WWF	-	World Wide Fund
WTS	-	Wood Tracking System

ABSTRACT

Ghana's timber industries have traditionally focussed on certifying international demand (exports) to the detriment of domestic wood consumption. The legal wood supply to the domestic market has become insufficient to satisfy the growing needs of the local population. This research aims at gaining greater insight into the sources of wood supply to Ghana's domestic wood markets focusing on the contribution of legal wood by the mainstream timber companies.

The study used random and purposive sampling techniques for selecting the respondents in the domestic wood market, wood producers as well as consumers. Additionally, the views of the respondents were sought through well semi-structured questionnaires. On the other hand, views from key informants, mostly experts, and regulators in Ghana's wood industry were solicited through interviews.

The result indicates that the formal timber processors supply 73% of their processed lumber to the export market and 27% to the domestic market. The destination of the 27% is both the domestic market and other lumber demanded sectors especially large scale construction and furniture companies. The carving industry on other hand obtains wood directly from the farmers and not necessary from the domestic wood market. At the domestic timber market, dealers receive lumber supply from both formal (16. 7%) and informal (83.3%) sources.

The domestic wood sector provides livelihood support to both wood dealers, consumers as well as artisans. About 70% of respondents (wood dealers) used in the survey have no other source of livelihood for existence except wood business.

Owing to the immense contribution of the domestic wood market to the country's economy and developmental agenda, a calls for policy review especially 20% supply of formal processed lumber to the domestic market is timely. Additionally, looking at the various interventions to curtail illegal chain saw and the continued market demand, the study believes more regulated measures will better help the nation to grasped huge revenue lost as a result of illegalities to embark on vigorous afforestation programs to sustain the domestic wood market.

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1. PREAMBLE

Globally, wood production and consumption have been on the rise over the years. This is owed to the fact that, there is more demand as a result of population growth, and individual taste and preference (FAO 2009). Sadly, this trend according to FAO will continue and the global consumption of industrial wood products is projected to reach 45% by 2020. Already, consumption of certain wood products such as pellets has gained popularity in recent years as people become environmentally conscious, and the products have the potential to be used as a green energy to meet renewable energy plans of most European countries (FAO 2014).

Wood supply to the international markets are differently sourced, most of the supplies from developed countries come from plantations established for specific purposes such as pulp and paper, industrial round-logs etc. On the other hand, wood from developing countries such as Ghana is usually tropical hardwood from the natural forest with less sustainability adherence in production and no or inappropriate forest management plans. This type of forest management practice maximises the effect of timber harvesting (logging) and biodiversity degradation promoting deforestation and negatively impacting on the global environmental services. Yet, contribution to global wood supply from these countries is important as revenues generated from natural resources (timber, mining, clear-cutting for agriculture etc.) forms an important percentage of GDP of most developing countries.

Sadly, the global need for wood and wood products has been predicted to keep growing in major products except for few like wood fuel (figure 1). This further gives incentives to exporting countries to increase production to improve export value and boost economic growth through forest and logging (figure 2).

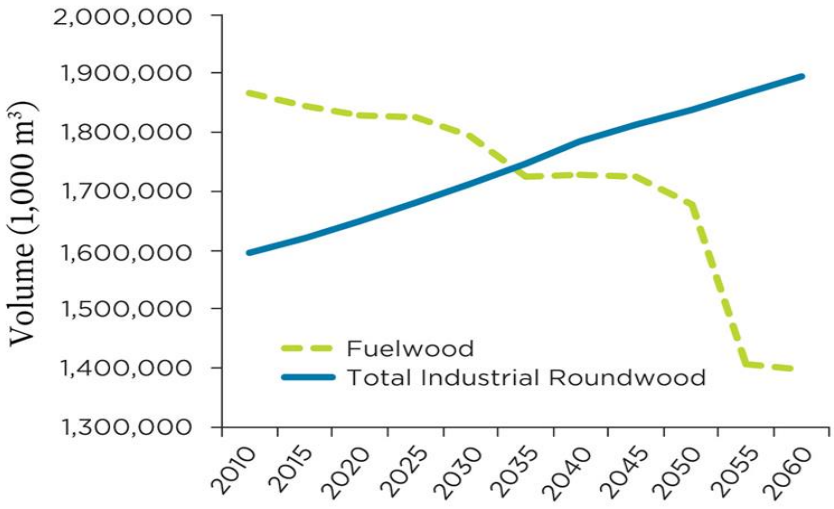

Figure 1: Global trend of wood demand for industrial round logs and fuelwood consumption

Source: (Elias & Boucher 2014)

As demand for wood grows, various means are exploited to respond to demand which degrades the forest especially in countries where regulation are weak and corruption takes precedence over law. Most developing countries like Congo, Ghana, Guyana, Myanmar, Papua New Guinea and the Solomon Islands employ selective logging in natural forest to meet its export demand in an unsustainable manner in the natural forest (Elias & Boucher 2014). According to FAO (2015), even though there was a global reduction in the net forest loss between 2010 and 2015, the majority of the loss has occurred in Africa, and South America, with 2.8 and 2 million ha forest loss respectively.

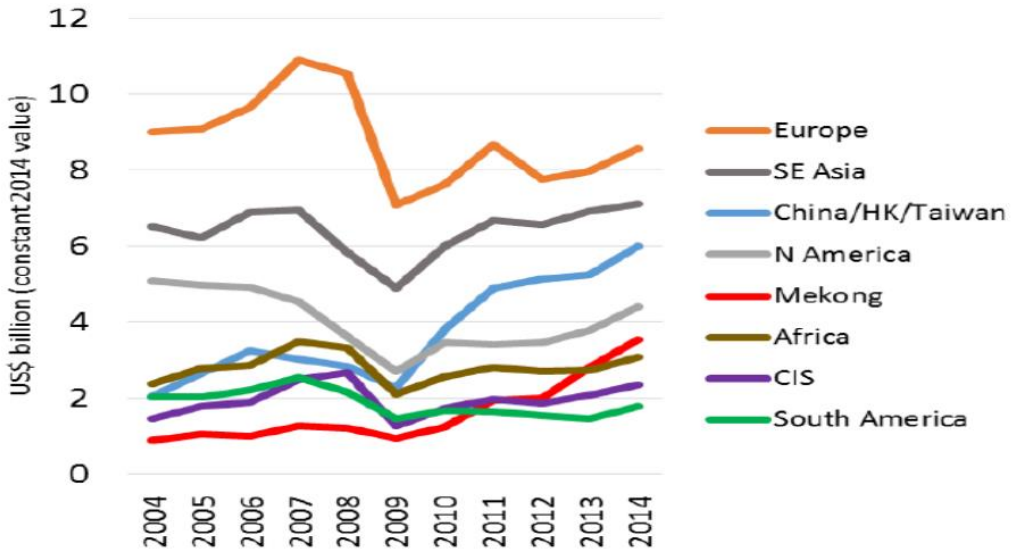

Figure 2: The global trade in hardwood by region of the exported country

Source:[1]

Exportation of raw sawn tropical hardwood products to the international markets from developing countries especially Africa has been a customary module of timber trade over many years. This type of primary products without value addition has significantly allowed more wood to be extracted with minimal monetary returns. The results of this are that Africa is being predicted to import wood in the near future (Global Environmental Fund 2013). It is worthy to note that, such sawn wood is processed in the destination countries and imported as consumable products back to developing countries killing domestic small-scale enterprises thereby increasing the unemployment rate. Obviously, this type of wood production is not sustainable and renders the timber resources base vulnerable to depletion and environmental degradation.

To sustainably meet the current wood demand requires appropriate policies and technologies in forest management and trade. This implies that more emphasis should be placed on value

[1] Update on FLEGT IMM and opportunities for the market. A presentation made by Rupert Oliver, ITTO/EC Independent Market Monitor for the VPA process.

addition (Agrawal et al. 2013). As of now, there is still a high dependency on the natural resources especially forestry to supplement national GDP in middle and low-income countries (see figure 3), yet, value addition forms a small portion of the general exportation of wood products from developing economies. It is foreseen that, due to increasing population growth, demand for the wood product will increase in response to population and economic growth.

Africa needs to explore secondary processed wood products (SPWD) export than raw sawn wood to international markets like China and Europe which are the major wood export destinations. This will help save the local timber industry and the remaining natural forest.

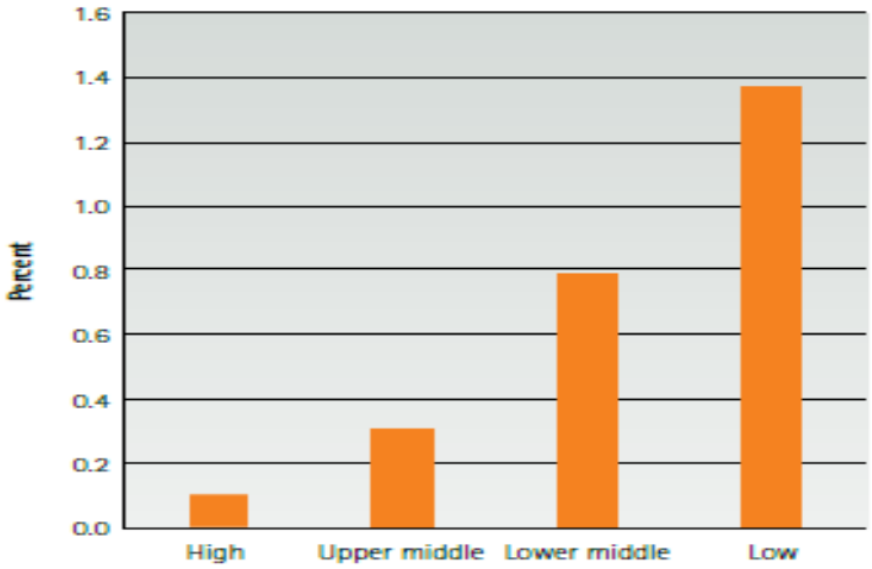

Figure 3: The contribution of forestry and logging to GDP by the level of income category country
Source: (FAO, 2015)

1.1 African Wood Needs

Production and consumption of wood products in Africa has grown over the years in all categories Grieg-Gran et al. (2015), and the continent has been predicted to export wood in the future to meet its wood requirement as wood demand for local consumption grows. A study by Global Environmental Facility (2013), identified that wood needs of Africa are estimated to be about 700 million cubic meters (m^3) per year and fuelwood consumption account for about 625 million m^3 with the rest consumed as industrial wood products. The dependency on the forest to meet Africa's wood demand in construction and energy (firewood) is exerting enormous pressure on the remaining forest and subsequently degrading the forest at a faster rate. Various land use strategies like agroforestry, afforestation and reforestation have been developed to produce wood and firewood from fast growing species such as *Acacia albida* (Acacia), *Tectona grandis* (teak) etc. for individual nations. However, Blaser et al. (2011) found out that, planted forest in

Africa constitutes only 4% of the world's total planted forest leaving a huge deficient of wood demand still unmet.

Africa needs to embrace vigorous, sustainable forest management and market instruments that require voluntary but strict adherence to improve forest management as well as raise forestry practices to global sustainability requirements. With a positive change in local forest governance facilitated by international and environmental pressure, the remaining African natural forest, complemented with wood plantation could be sustainably managed to meet future wood demand and provide global environmental benefits as a fallout from sustainable practices. Regrettably, most of the wood products consumed in Africa are imported onto the continent from developed and transitional economies, which are the major destinations of Africa wood export. In 2011, wood products imported into the continent was US$8.5 billion. This was more than the total value of wood products exported from the continent which stood at $ 5.1 billion (Grieg-Gran et al. 2015). The implication of such inverse wood export and imports, suggests that Africa lacks the technology and capacity to produce high value-added wood products locally and relies on the exportation of primary wood products and importation of tertiary product for local consumption.

2. GHANA'S TIMBER INDUSTRY

Ghana has a vibrant timber industry that directly employs about 120.000 of its population (Government of Ghana 2012). The sector indirectly serves as a source of livelihood to a wide range of people in both rural and urban settlements (Tabi Agyarko 2001). Wood products export constitute the third foreign income earner to the country's economy Sutton & Kpentey (2012), and contributed 2.2% to GDP through Forestry and Logging in 2013 (Ghana Statistical Service 2014; Oduro et al. 2011). The timber industry serves the international wood demand through export of high-quality tropical wood and wood products worldwide. Europe and the United States were the major export destination for Ghana's wood products (Acquah et al. 2014).

The timber industry in Ghana is dominated by the informal sector which supplies 53% of the domestic wood requirement whilst the formal sector accounts for 13% with the remaining supplemented by wood products importation (Sutton & Kpentey 2012). Unfortunately, the number of companies within Ghana's wood industry sector has decreased in recent years. Sutton & Kpentey (2012), further identified that the number of wood processing companies that had existed and operated during the early 1990s (see table 1) has declined drastically to about 100 sawmills with different product categories. This has affected all sectors that directly or indirectly depend or connected with the industry. Additionally, export earnings from the sector have also decreased evidently by the 13% decrease in value recorded in September 2013 (€7,536,507.29) as compared to (€8,637,092.59) in August 2012 (Ghana Investment Promotion Centre 2016).

Table 1: Number of companies involved in wood processing and major activities in the early 90s

Category	Activities	No. of firms
Primary	Logging	250
Secondary	Air-dried lumber	153
	Kiln-dried lumber	71
	Ply-milling	15
	Sliced veneer	19
	Rotary veneer	18
	Treated poles	3
Tertiary	Furniture	53
	Particle boards	2
	Flooring	10
	Doors	8
	Mouldings	45
	Toys	5
	small-scale carpentry	300

Source: (Sutton & Kpentey, 2012)

The wood industry is made up of about 95% companies that combine both wood processing and logging activities to satisfy export and local consumption The remaining 5% companies comprise of about 70 small scale processing facilities that target local consumption solely (Domson & Vlosky 2010).

2.1. Export destination of Ghana's wood products

Wood products from Ghana are exported around the world. European Union (EU) countries used to be the major export destination with market shares of about 57% in 2000. In recent times, however, there has been a decline to an estimated 15% in 2015 (figure 4). This has given way to emergent markets in Asia and neighbouring Africa states to also play an active role in Ghana's wood export industry. The aforementioned decline could be attributed to many factors including strict international trade regulations (such as Forest Law Enforcement Governance and Trade (FLEGT) and Voluntary Partnership Agreement (VPA) requirement by the European Union.

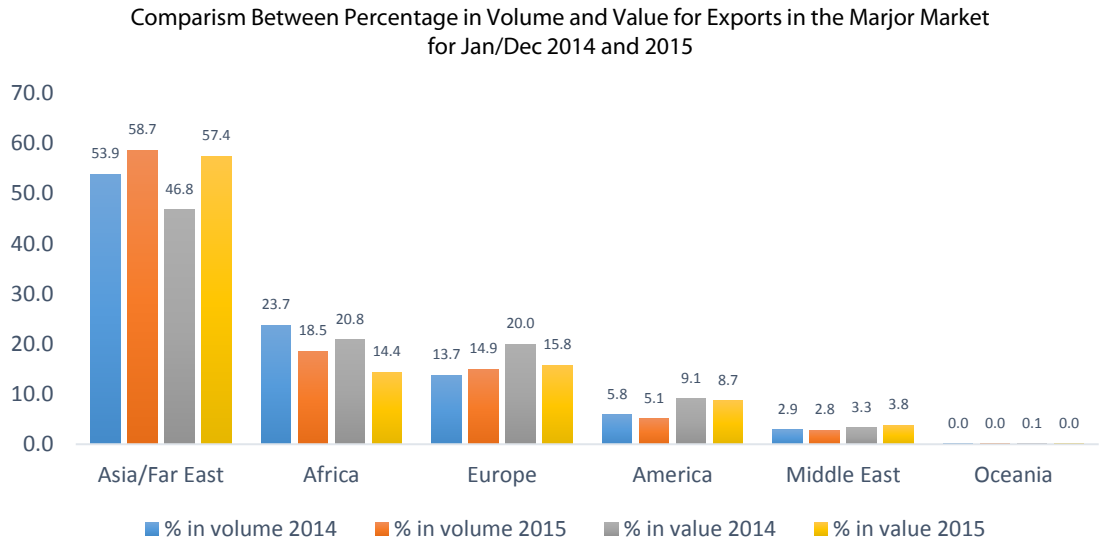

Figure 4: Major importing countries of Ghana's wood products

Source: (constructed from TIDD report from Jan-Dec. 2015).

Recently, the share of other African countries in Ghana's wood products and export trade has increased with most products destined to ECOWAS sub-region. About 79% of the total wood exported to other African countries went to ECOWAS states and the remaining 21% shared between South Africa, Morocco and Cape Verde (Acquah et al. 2014). Emerging economies such as Asia /Far East, Malaysia, Taiwan, China, Singapore, and Thailand in 2008 contributed 15.97% to Ghana's total export value (Quartey 2012). In 2012, according to TIDD (2013), the contribution from these countries rose to 25.45% of Ghana's total exports value.

2.2. Major Wood Products

Ghana exports different types of wood products to the international market. Most of the markets determine a specific product to be exported to such market. Wood product exports and trade is heavily concentrated on about 15 leading companies. These companies produce different categories of wood products such as Lumber, Sliced Veneer, Plywood, Poles, Mouldings, Rotary Veneer, Billet, Boules, Dowels etc. and accounts for about 70% of the total export earnings (Oteng-Amoako et al. 2008)

2.3. Value Addition

Even though there is a decrease in the wood export sector, Ghana's wood products perform well on the international market with about 2.2% contribution to global tropical wood needs (Tabi Agyarko 2001). The contribution is expected to increase due to general worldwide increasing demand for wood products. This implies that Ghana needs to employ production, processing as well as trade strategies to sustain its global share in the industry. According to (Sutton & Kpentey 2012; Tabi Agyarko 2001; Domson & Vlosky 2010), the industry still relies on outdated technologies and processes, which has not changed over the last twenty years. These, coupled with unsustainable resource base among other things, hinder Ghana's ability to maintain its global share of tropical wood supply. As the resource base decreases, continuous reliance on production and exportation of primary and secondary wood products will degrade the remaining forest land. A high percentage of the total wood products export mainly focus on secondary wood products (figure 5), which usually have less value addition and products value compared to tertiary wood products.

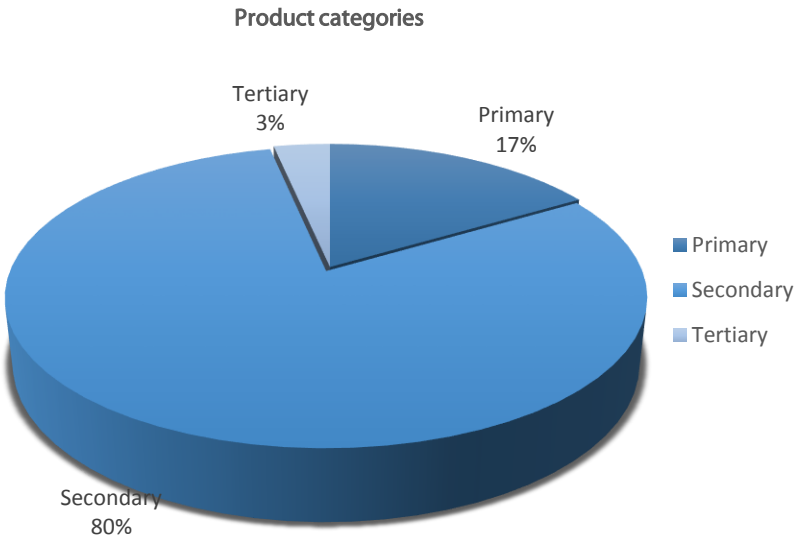

Figure 5: Percentage of product categories exported from Ghana in 2015

Source: (constructed from TIDD report from Jan-Dec. 2015)

The tertiary product sector of the wood industry has the potential of curbing national unemployment, contributing to foreign exchange and diversifying economic activities to improve livelihood. This potential is however not fully exploited. The sector is usually small family size businesses, which lack technology and modern equipment to compete in the international market. The sector needs a transformation that embraces value addition, improved technology, and machinery to enhance efficiency and product output. This is very crucial, as focusing on tertiary products with enhanced technical know-how will increase products value and ensure resource use efficiency. It is worth stating that home and garden furniture, furniture parts, laminated doors and window parts etc. with a growing demand in the US and European market have not been targeted over years by the wood industry in Ghana. The consequence of this is limiting the potential benefits that could have been gained from increased export value and secured market share through production and export of high-quality value-added tropical wood product (Acquah & Whyte 1998; Acquah et al. 2014). The rather small portion of value added product that forms part of the wood product export has also declined in recent years as depicted in figure 5. Out of the total export, only 3% wood products export comes from tertiary products. Dadzie et al. (2015), made known that, garden furniture which is a tertiary wood product attracted much high monetary value per cubic meter (m^3) in all species studied than lumber (secondary product) and concluded that per m^3, of tertiary wood products offer much more monetary earnings in comparison to lumber and should, therefore, be encouraged. Yet, the economic advantage of tertiary wood production on the global market has not been exploited to the benefit of the industry.

2.4. Trend in Ghana's wood supply

The contribution of Ghana wood supply to the international market has been declining over the years (figure 6). The decrease is prominent in the contribution to supply of tropical timber species at both global and domestic market. Many reasons could be attributed to this decline among which Dadebo & Shinohara (1999) brought to bare may be due to resource degradation and ineffective governance structure within the industry.

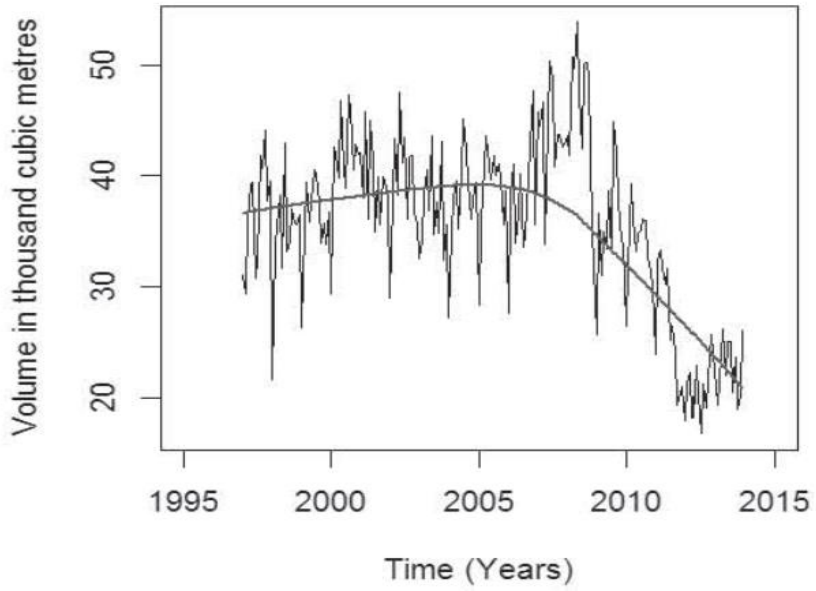

Figure 6: Changing trend in Ghana's wood supply to the international market
Source: (Acquah et al 2014).

2.5 Ghana's domestic wood Market

The Ghanaian local wood market constitutes the informal sector of the wood industry and offers employment and livelihoods support to many people along the chain from forestry to lumber production and consumption. The market consist of lumber traders, small and medium carpenters for household and industrial consumption, craftsmen and artisans for both domestic and international markets etc. The contribution of this sector to the national economy can therefore not be underestimated as it helps to increase income and improve the livelihood of many Ghanaians (Grieg-Gran et al. 2015). The domestic market satisfies different categories of consumers. Individuals, companies, as well as the government, rely on the domestic market for various wood needs. Tabi Agyarko (2001), found out that, the domestic lumber market is the raw material source, which sustains the following traders among others,

1. Small scale furniture manufacturing companies
2. Truck body builders/boat builders
3. Pallets and Crate Users
4. Construction Companies (housing developers)
5. Overland wood product exporters
6. Wood Carvers etc.

Yet, wood supply to the domestic market forms only a small fraction of the quantity export to the international market. Out of the total exported wood products of 586,865 m3 in 2008, only 15% of this volume were sold in the domestic market (Government of Ghana 2012). Sadly, Wood

supply to the domestic markets is often the rejects and fall outs from export contracts which are of lower grades and therefore low quality (Boampong et al., 2015). It is estimated that only 152,660 m^3 of lumber is available for local consumptions whiles demand is about 450 000 m^3 (Odoom 2005; Tabi Agyarko 2001). The wood sector is growing and the wood markets are spreading across the major regional capitals in the country especially Accra and Kumasi with the biggest wood market in Ghana located in Kumasi (figure 7) (Domson 2007).

As the population grows, the demand for wood also increases and it is inevitable that wood supply to the domestic market is insufficient to adequately satisfy the growing needs of the population posing a huge challenge to the sector (Oteng-Amoako et al. 2008). The market is currently under pressure from growing demands especially in the building and construction industry and other sectors such as the wooden furniture industry. This trend has resulted in middlemen mostly queuing at factory gates for supply whilst others seek alternative sources of wood supply to sustain the markets.

Figure 7: Sokoban wood market in Ghana
Source of photo[2]

2.5.1. Furniture sector

The furniture industry used to be a very vibrant sector in the country offering employment to a large number of people both educated and non-educated. The sector has been estimated to be the highest single consumer of the local wood demand accounting for about 74% of the wood requirement in the domestic market (Oteng-Amoako et al. 2008; Gerhardt & Stokke 2001). The sector is gradually dwindling and giving way to the importation of household and office furniture from other countries such as China, Singapore, Malaysia, and the European Union (Nutsuego 2015). Adupong (2011) reveals that Association of Ghana Industries (AGI) conducted a study and

[2] http://www.tropenbos.org/news/communication+facility+inaugurated+at+the+sokobhan+wood+village

came out with the fact that 78% of the furniture on the market is imported. This is as a result of the unavailability of quality raw material supply in the market necessitating a price distortion due to the presence of middlemen along the supply chain (Boampong et al. 2015; Oteng-Amoako et al. 2008). The sector has been negatively impacted due to the disparity between demand and supply of wood (Pumomo et al. 2011). Currently, the furniture industry is near collapse and cannot compete internationally causing the collapse of most of the companies in the major cities (Nutassey et al. 2014). The few that still remain in this regard also do not have the capacity to compete internationally due to factors including; lack of raw material, modern processing technology, and appropriate machinery/equipment etc.

2.5.2. Carpentry sector

According to Oteng Amoako, et al. (2008), about 50% of the total wood required in the domestic market is used by the small-scale carpenters to produce various wood products for domestic consumption. This sector does not function along any streamlined national regulations except few associations which are not mandatory to participate. Wood is the main raw material for the industry and the carpenters rely on the lumber traders within the domestic market for their wood requirement (Gerhardt & Stokke, 2001). The carpentry sector produces different products from school desk and chairs to stools, benches, doors, windows, door & window frames etc. The carpentry sector can be categorized into two broad classes; those who produce low and cheap products to satisfy the low- class and those that target the middle class and have the capacity to produce for organizations and government contracts (Gerhardt & Stokke, 2001). The coffin making branch of the carpentry sector is an interesting aspect that has an international recognition due to the uniqueness of the figurative designs that often depict the profession of the deceased whilst alive.

Figure 8: A coffin made in the shape of a fish signifying that the dead person was a fisherman[3].

[3] source of photo: https://www.theguardian.com/world/gallery/2013/feb/07/ghana-coffins-in-pictures

2.5.3. Construction and building sector

The increasing demand for improved infrastructure for economic development and shelter driven by population growth and or urbanization has exerted massive pressure on the construction and building industry in Ghana. It is one sector with the vast potential of generating youth employment especially in developing countries (Ramsaran & Hosein 2006). This notwithstanding, the sector relies on the Timber and Wood industry for its wood requirements. Any development in this sector puts burdens on the timber industry as quality lumber and wood products are needed especially for roof trusses (figure 8). In developing countries like Ghana, the sector further consumes high wood as the doors, windows and their frames, as well as the furniture, are mostly made out of wood. In some cases, the whole building is constructed from wood. This is evident in rural Ghanaian settings, where wooden houses are perceived to be a sign of poverty. Recent research has, however, found wooden houses to be a sound option for climate change impact mitigation since a cubic meter of wood absorbs 900kg of CO_2 whilst concreated houses, which are much preferred and modern emits 140 kg of CO_2 into the atmosphere (forest stewardship council FSC 2014). Nowadays and very much prominent in the urban and developed countries, most of these wood required in the housing sector is being replaced by plastic products (figure 9) due to unavailability of the wood and/or financial restraints as these plastic products are less expensive and convenient to use (Nt & Sue 2016).

Figure 9a: A building at the roof trusses level and showing how much wood is required in the building industry

Source: (Elias & Boucher, 2014)

Figure9b: Plastic material used in the building industry instead of the traditional wood

Source: (Hansel Cox 2016)

2.5.4. Carvings industry

The carving industry in Ghana is noted for its outstanding creativity and quality, simply because of the quality of wood used to produce the artefact. The industry produces both traditional and

contemporary masterpieces with symbolic meaning most of which are connected with cultural and traditional beliefs. The industry serves both domestic and international markets with Europe and the United State being the major export destination (Cudjoe 2005). The carving industry has been given prominence in recent years as the government of Ghana aims to diversify export through the promotion of non-traditional export focusing on the tourism industry which includes wood carving. Wood is the main raw material used in the industry which was previously felled and used by the carvers. Recently, however, the industry depends on the timber industry to meet its raw material needs (Adu-Agyem, Sabutey & Emmanuel 2013). As the sector develops, more wood is needed to feed the sector, which means that, the timber industry must be able to provide enough wood required to sustain the sector. Though economically significant in supporting livelihoods, the carving industry faces challenges as its raw material source is not currently sustainable (Obeng et al. 2011).

2.6. Sustainable Forest Management

Sustainable Forest management (SFM) is an all-important subject especially because deforestation rates and/or forest degradation has not been slow down. This state of affairs has gained prominence in all natural resource dialogues due to the key role natural resource play in the livelihoods of its people especially in developing countries where forest destruction is very high as compared to the developed countries. (Owubah et al. 2001). Global attempt to curb the situation has not yielded much as destruction still persist and efforts to encourage sustainable forest management at a national and regional level has also not achieved much as desired.

Sustainable forest management concept is based on sustainable development pillars and addresses clashes between the different interests, especially between social, economic and environmental interests in natural resources management (MacDicken et al. 2015). The concept provides principles as well as criteria and indicators through which sustainability could be measured. SFM ensures that current forest-dependent livelihoods are improved while at the same time retaining the integrity of ecological systems to satisfy the needs of the next generation (United Nations 1992)

As the population grows, demand on forest resources to meet human needs increases alongside consequences that are likely to arise due to forest cover change that results from urbanization and/or Agriculture. The target of most developing nations for economic growth further threatens the forest as revenue from natural resources (timber, mining, clear-cutting for agriculture etc.) form an important percentage of Gross Domestic Product (GDP), especially in Africa. Enforcing

regional and national commitments to SFM principles is vital to ensure the perpetual flow of forest benefits on a sustainable basis for all segment of society (Chhatre & Agrawal 2008).

2.7. Ghana's forest resources

The forest cover of Ghana is estimated at 9.17 million ha comprising of High Forest and Transitional Forest Zone of 8.1342 and 1.036 million ha respectively. These are rich areas of commercial timber species whiles the Savannah Zone has about 14.66 million ha without commercial timber (Teye 2008). The Same source also reviewed that, Ghana has reserved 214 forest lands (without Wildlife reserves) covering an area of 1,774,500 ha of which 47% is under timber production. The manual of procedures of the Planning Branch also documented that, the off-reserves consist of many commercial timber species and occur mostly on agriculture land (Planning Branch 1999).

It has been identified that the forest cover has degraded so much in recent years after it was last measured. The measure reviewed that, the country lost about 80% (8m ha – 1.6m ha) of its forest between 1900-1990 (Opoku 2006). This menace and fear of continuous degradation and deforestation are highly anticipated. As the demand for forest resource increases in both economic and ecological provision, the rate of destruction intensifies and both biological and physical composition of the forest is negatively altered. This hinders the provisions of benefits that forest fringe communities would otherwise have enjoyed from the forest. The forest fringe communities depends largely on the forest to satisfy basic needs as well as providing the household energy requirement for a large number of people both in the rural and the urban areas (World Bank 2007)

The high forest lost in the past and recent years can be attributed to the high intensity of logging activities in the country. Although there are laws governing timber exploitation, such laws are usually weak in their implementation and supervision. This allows timber merchants to take advantage and exploit the resource in unstainable manners. Additionally, the aforementioned, high-intensity logging, could be attributed to the timber export sector during the 1980s as part of the Economic Recovery Program (ERP) (World Bank 2007).

2.7.1. Strategies towards sustainable wood supply

In the quest to protect Ghana's natural resources and ensure environmental quality, the government of Ghana has shown commitment towards sustainable forest measures. This is evident in the signing and ratification of international forest sustainability agreements on globally acceptable forest resources management practices. This includes among others, the

Voluntary Partnership Agreement (VPA), International Tropical Timber Agreement (ITTA) and Reduced Emissions from Deforestation and Degradation plus (REDD+).

Locally, Ghana has attempted various market instruments, command and control strategies in the form of Act and regulations to control forest resource utilization that targets curbing deforestation to sustain the forest resource base. These measures were taken even before the realization that the rate of exploitation far exceeds regeneration capacity. Various laws and regulations have been formulated both before and after the colonial era to define timber right and utilization for sustainable timber resource consumption. The use of command and control system of forest management between 1927 and 1980 contributed immensely to high deforestation rate, especially through illegal logging. In the 1990s however, many reforms such as the replacement of the 15 years felling cycle to 40 years Parren & Reize de Graaf (1995) was made to regulate timber harvesting based on sound silvicultural principles and systems that ensure resource sustainability and maintained high ecological value (Hansen & Treue 2008).

Most of the sustainable forest Laws and regulations were targeted at the timber industry to specifically govern their activities in order to reduce deforestation through illegalities and to encourage trade in legal timber to both domestic and international market (Oduro et al. 2011). This notwithstanding, much were not achieved and the rate of deforestation continued to increase, The most comprehensive form of Act was the Timber Resources Management Act and Timber Resources Management Regulations, which replace formally formulated laws on timber rights and utilizations and provides that timber right is granted in terms of Timber Utilization Contracts (TUCs) through competitive bidding (Government of Ghana 1997). Though there are concerns about certain aspects of the Act being difficult to implement (Bird et al. 2006), it is currently in practice with a possibility of addressing the various challenges in order to fully realize its potential of attaining ecological and economic benefits (Kufour 2000).

2.7.2. International Instrument to sustain Ghana's Wood Supply

Finding sustainable options for forest management faces huge challenges and this has gained global attention where different approach have been proposed for adoption to curb climate change impact at the global south.

Whiles forest degradation is a major contributor to greenhouse gases emissions, interestingly, the forest is known to be a major sink of greenhouse gases. The idea is to find an ecological option where benefits could be derived from the forest without causing harm to the climate. To this, lots of international regulations and market tool options in the form of products certification have been in practice where forest operation are expected to adhere to sustainable standards and

principles to ensure sound global climate. Ghana at the national level has signed on to some of this international regulations to ensure sustainability of the timber resource base.

2.7.3. International certification programs

Individuals and companies in Ghana have been enrolled under international certification bodies like Forest Stewardship Council (FSC) certification. The FSC provides an avenue for sustainable management where wood products attract price premium in the international market. The benefits of these standards nonetheless depend on the quality of the products and differ between countries (Potts et al. 2014). Companies also agree that signing on to FSC enhances companies' image through the display of the FSC logo on products and the improvement of corporate social responsibility towards forest fringe communities (Nukpezah et al. 2014). But Attah et al, (2010) found out that, the eagerness of companies to adopt to a chain of custody certifications which is a component of FCS certification program is rather low due to knowledge gap with regards to price premium and stakeholders' awareness and involvement. The establishment of Global Forest Trade Network (GFTN) in Ghana has contributed immensely to sustainability discourse and offer support to companies and individual to help meet their certification requirements (WWF 2016).

2.7.4. Voluntary partnership agreement (VPA)

Ghana was among the first countries to sign on to Voluntary Partnership Agreement (VPA) with the European Union in 2008 (Attah et al. 2011). The agreement was to provide among others, a robust system of timber utilization processes that ensure sustainability of the timber resource base and prevent environmental degradation.

Ghana agreed and adopted the VPA process owing to the fact that, it has long detected a massive decline and misuse of the timber resources the country is endowed with. This was as a result of lack of the country's ability to control anthropological activities such as improper logging practices, illegal timber harvesting, conversion of forest to agriculture land, bush fires etc. identified by Insaidoo et al. (2012) as being the major causal agents of deforestation. Even though these economic activities are associated with bad environmental outcomes, it holds a significant part of the country GDP (Shafik 1994).

The VPA mechanism was therefore seen as a way to streamline these activities in a socially acceptable, economically beneficial and environmentally sustainable manner for both national and global gains. The timber resources management in Ghana has undergone both institutional and procedural changes in order to meet the VPA requirement. By signing on to VPA, the country is presented with the opportunity to enjoy various development assistance from the EU in an

exchange for commitment to proving only legal wood products to the EU market (Beeko & Arts 2010). Ghana signed on to the agreement primarily to protect and secure its market share in the EU countries as they were the biggest consuming nation of Ghana's wood products at the introduction of the VPA agreement (Acquah et al. 2014).

The VPA in a broader sense is seen as a timber trade tools that ensure that only legal wood products are offered to the EU markets in a transparent governance system and involve the participation of all stakeholders. Subsequently, the VPA is included in the Forest Law Enforcement Governance and Trade (FLEGT) action plan of the European Union. The aim of this measure is presumed to restrict and prevent illegal timber trade and offer incentives to participating countries through a market mechanism (European Commission 2003).

FLEGT among others seeks to provide adequate law enforcement and proper governance that is built on sustainable forest management in the timber industry and encourage timber trade founded on legal and responsible practices. Under the FLEGT/VPA arrangement, Ghana has formulated various regulations and policies and undergone institutional restructuring to position itself to be able to merge the existing local timber laws and regulations into FLEGT/VPA requirements. This process has involved a lot of stakeholder discussion and negotiations at national and international level. In accordance with VPA/FLEGT requirement, Ghana's legal timber has been redefined to include production and processing standard and criteria that are verifiable and skewed towards program compliance based on sustainable development pillars.

Under the FLEGT/VPA agreement, a FLEGT license would only be issued after timber product consignment has fulfilled all the criteria, indicators and verifiers as stipulated in the agreement (European Commision & Ghana 2009)

- *Institutional change*

The Forestry Commission of Ghana (FC) is a state institution which has been charged with the responsibility to manage the nation's forest and wildlife resources. It has developed systems and structures and positioned itself to adequately perform its mandate in accordance with the VPA requirements. To achieve this, the Commission has set up a department (Timber Validation Department) alongside many other institutional changes and has been mandated to see to the achievement of this requirement.

- *Legality Assurance System (LAS)*

The Legality Assurance System (LAS) is a comprehensive system established by the forestry commission together with its development partners and all stakeholders. It is a requirement of the VPA to monitor forest management and ensure legality in the international and local timber trade. With this system, the partner country is able to trace timber and wood products offered on the market to the actual source and verified to see if the wood was legally and properly sourced (LTC International 2010).

- *Wood Tracking System (WTS)*

The Wood Tracking System (WTS) is a component under LAS of the VPA/FLEGHT mechanism that provides a reliable system of tracking wood products from the forest stand through to production, processing and subsequent shipping or sales at the domestic wood market (Tropenbos International 2013). It provides immediate information on the legal status of the log or products with the bearing of the FLEGT license or Leg

3. RESEARCH METHODOLOGY

3.1. Introduction

Having reviewed literature in detailed on sources of wood for the local market, analyzing framework for formal wood supply and emerging wood market demand, this chapter focuses on conceptualize framework and the approach for realizing the research objectives.

3.2. Conceptualized Framework

The logical approach used to realize the set objectives of this study is described in this section. The increasing trend of global wood demand with its tripling effects on domestic need for wood and wood products has encouraged the sub-region and countries to drive for various sustainability measures to curb the menace of unstainable forest resource management and utilization. In Ghana, various regulations; LI 1649, TUP and VPA agreement; have been implemented with the hope to regulate wood supply to sustain both the export and local market. For the purposes of this study, two main channels of sources of wood supply to the domestic market would be considered. These are the formal (authorised logging) and the informal (unauthorized logging) source of wood. Both channels constitute the supply side which is driven by the factors of demand. The demand side constitutes all sectors that sources wood from the domestic market. This study also tried to examine the critical role played by the domestic wood market in Ghana and the magnitude of possible livelihood challenges likely to occur in a case of wood shortage. The framework also assesses the importance of wood to the local economy in order to influence policy decision. With continues dependence of wood in the local market the study will explore interdisciplinary approaches to sustain the local market through the best practice.

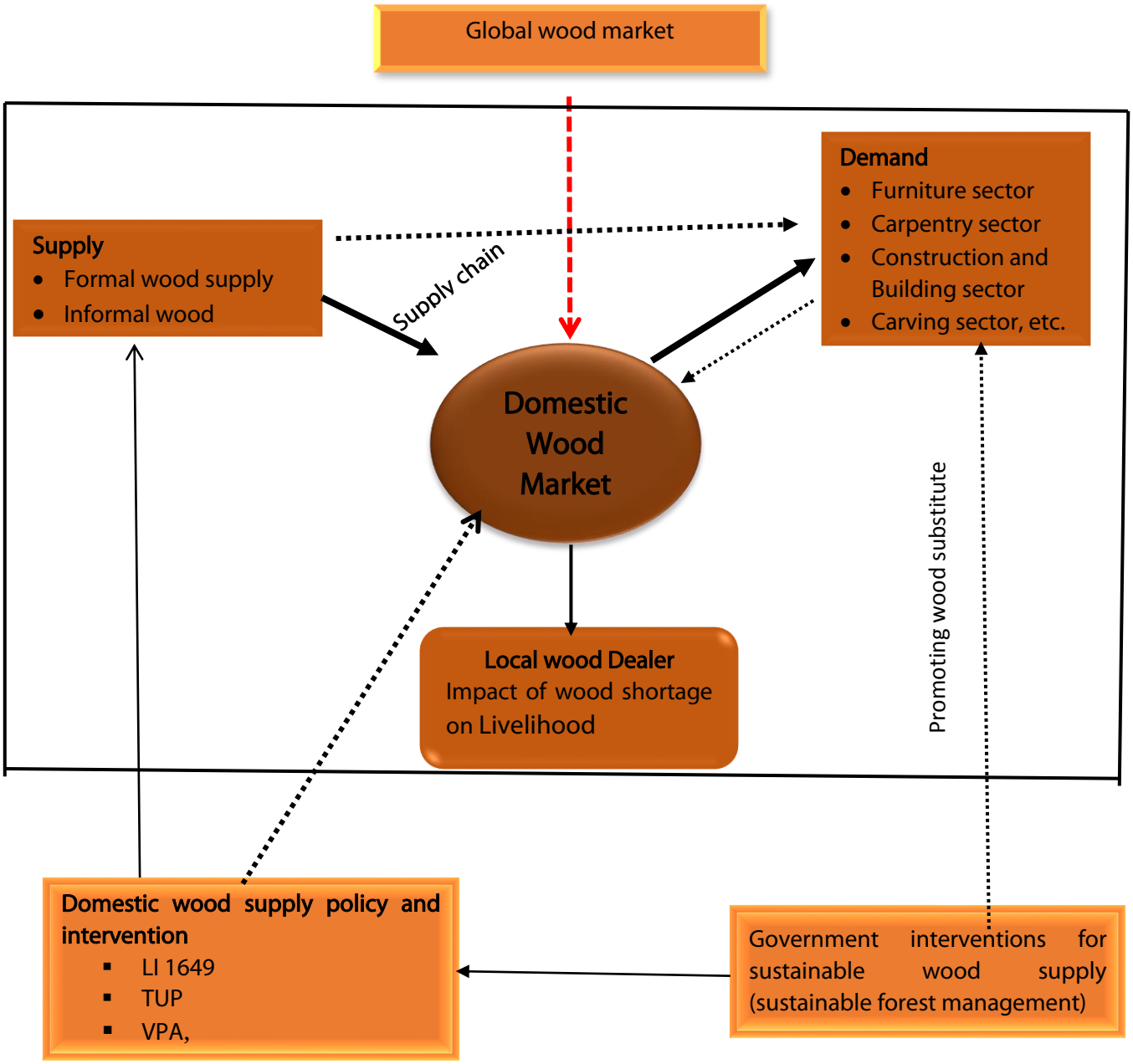

Figure 10: A conceptual framework for analyzing Ghana's domestic wood market.

Source: Author's construct.

3.3. Profile of the Study Area

Ghana is the first Sub-Saharan West-African country to gain independence in 1957. It is located on the geographic coordinates 8° 00'N, 2° 00'W and surrounded by neighboring Cote d'voi Togo and Burkina Faso. The country covers a total area of approximately 238,533 km2 (227,533 km2 land and 11, 000 km2 water) and has a population of 26,908,262 million with a 2.18% population growth rate. Agriculture (which employs more than half of the workforce) serves a major economic activity, accounting for roughly a quarter of its total GDP. The forest covers about 21.2% of the total land surface in Ghana. Forestry is a major and important sector as it contributes

to GDP through export of wood and wood products. The total GDP of the country in the year 2015 stood at $42.76 billion US with a 3.3% GDP growth rate in 2016 and an inflation rate of 17.8% in 2016 (World Factbook 2017).

Figure 11: Map of Ghana showing the major cities and riparian countries.

Source[4]

Being a tropical country, it is warm and relatively dry along the southeast coast, hot and dry when one moves towards the north and changes to humid and hot in the southwestern parts. Ghana is endowed with abundant natural resources such as gold, bauxite, silver, manganese, salt, timber rubber and recently discovered offshore oil. To ensure that it natural resources are sustained and protected, the country has signed onto various Environment - international agreements which aim to protect and secure the environment. This include among others laws on Biodiversity, Climate Change, Climate Change-Kyoto Protocol, Desertification, Endangered Species, Environmental Modification, Hazardous Wastes, Law of the Sea, Ozone Layer Protection, Ship Pollution, Tropical Timber 83, Tropical Timber 94, Wetlands etc. (World Factbook 2017).

[4] https://www.cia.gov/library/publications/the-world-factbook/graphics/maps/gh-map.gif

Ghana is divided into 10 administrative regions. The Ashanti region is the study region and the second most populated region in Ghana. It is located in the middle belt and forms part of the High Forest Zone of the country. The total land area is 24, 390 square kilometres which is about 10.2% of the land area of the country. According to Ghana statistical service (2012). The region is populated by 4,780,380 and denotes 19.4% of the national population.

Kumasi is the capital city of Ashanti region. The city was chosen for the study because it host a many wood market centre including the biggest wood market in the country. It also houses a number of timber processing companies ranging from multinational to family size timber firms. Data gathered could, therefore, be a representation of all segments of the market and firms which increase its potential for generalization to the entire country.

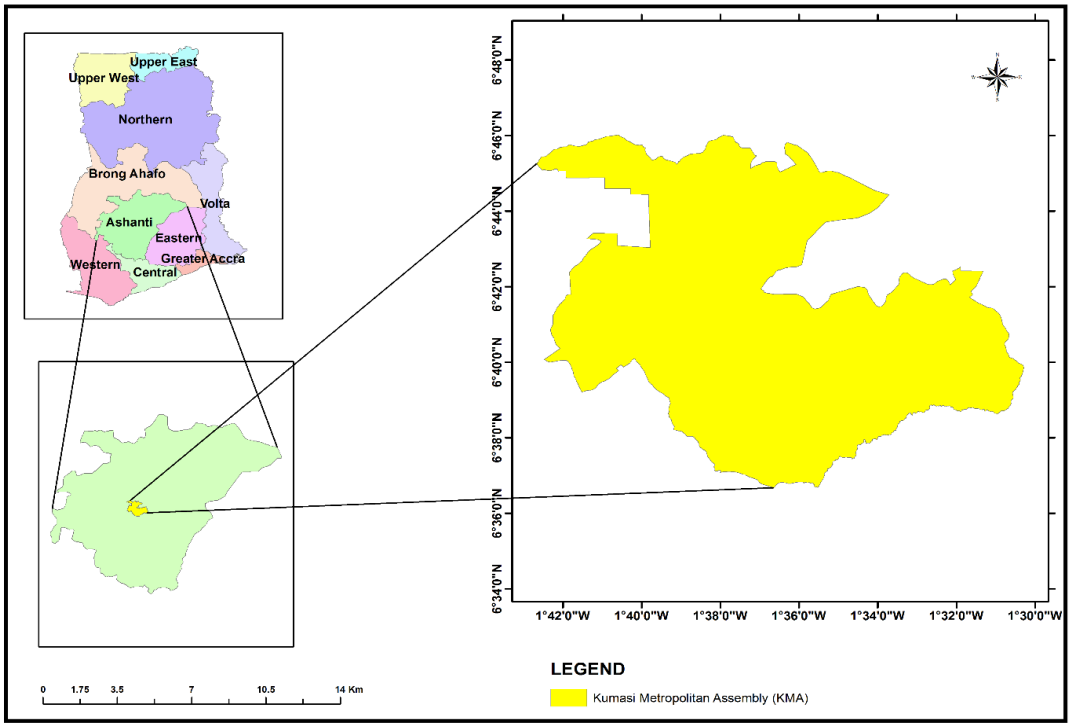

Figure 12: Map of Ghana showing the 10 administrative regions and the study area.

Source: Author's construct

3.4. Research Design

According to Kincaid H (2001), a research design is a plan outlining how information is to be gathered for an assessment, the instruments to be used, how the instruments will be administered, and how the information will be organized and analyzed (figure 1). This study is an applied research which seeks to identify the sources of wood that feeds the domestic wood market and access among others, the contribution of timber processing companies (formal) in meeting the domestic wood needs. Emphasis is also placed on some past and existing

government intervention aimed at sustaining the resource base in order to ensure a continuous supply of wood to the market.

The study employed field survey to obtain primary information. Individuals and targeted organization were categorized and used as the units of analysis in the research design as suggested by (Babbie 1989). This design was deemed appropriate because it offers the opportunity to gather primary data that directly connect to supply and demand factors of wood source. Considering the resource available and the time frame for completing the study, it was believed the design will provide answers to the initial research question.

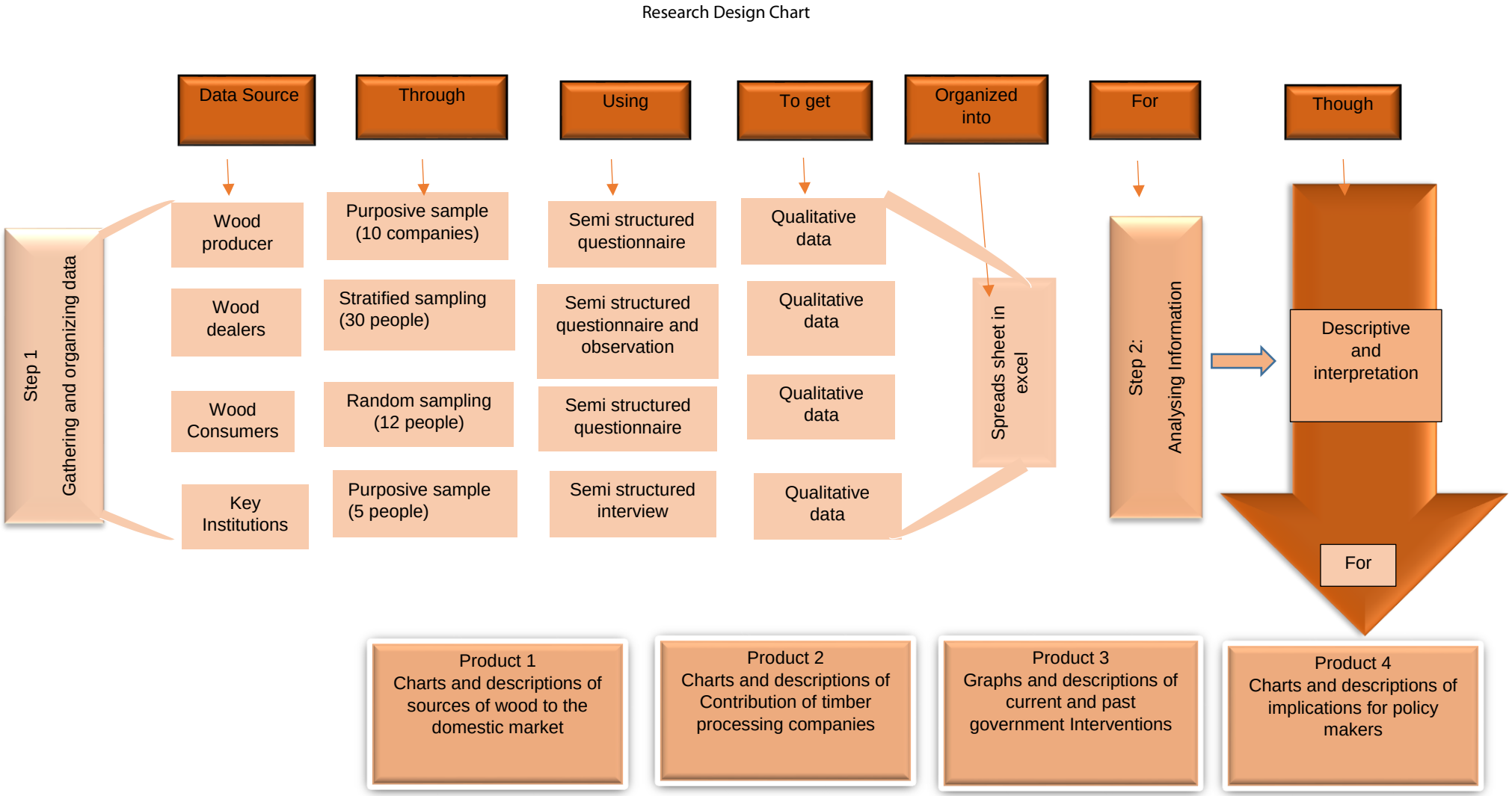

Figure 13: A research design showing how all the major parts of the research such as samples and methods of data collection work together to address the main research question (Gregor, 2002)

Source: Own Construct.

Study population

In order to achieve the objectives of the study, a population consisting of the following group in the study area were targeted and sampled for the study.

1. *Wood producers*: this was used to describe timber processing companies as well as small scale millers who may or may not have Timber Utilization Contract (TUC) with the Forestry Commission (FC) and may or may not own legal land mainly for timber harvesting in a forest reserve and/or off-reserve area. Usually, those without TUC buy from loggers who have no sawmills. Their timber harvesting operation is guided by rules and regulations and is subjected to punishment on default. Most of these companies have acquired degraded land for plantation establishment. They are usually registered and pay all the necessary taxes applicable in the sector. They use appropriate technology and machinery in the production chain and employ value addition to its products.

2. *Wood dealers*: these are individual wood sellers or merchants within the domestic wood market whose livelihood is directly dependent on the availability of wood in the market.

3. *Wood consumers*: these are individuals and companies who use wood and its product as a raw material in their jobs or home consumption (working definition).

4. Institutions; Institutions responsible for regulating, managing and promoting forest and wood products in Ghana or whose activities directly or indirectly impacts on the domestic wood market were also incorporated and interviewed in the study. These were representatives of Timber Industry Development Division (TIDD), Forest Services Division (FSD), Wood Sellers Association (WSA), Tropenbos Intentional Ghana (TBI), and Kumasi Wood Cluster (KWC). Representatives from the above institutions were selected based on their knowledge as a result of the position they occupy.

Sampling Techniques and Selection of Respondents

According to Grandhi (2004), a sample is defined as a small subset of the population that has been chosen to be studied. However, Lunsford and Lunsford (1995) cautioned that the sample chosen must be a good representation of the population and have sufficient size. This will allow for generalization to the entire population from which the sample was chosen (Saunders et. al, 2009). The study employed the use of identifying and defining suitable respondents for the study and employed both simple stratified sampling, purposive sampling, as well as simple random sampling as techniques for the selection of the study population. In the end, four target groups (describe above), were selected for data gathering. The simple stratified sampling was used to

select 30 respondents from the dealer group based on its heterogeneous nature. This was further divided into 3 subgroups taking into account the size of stalls to reflect big, medium and small size stalls. Random sampling was then used to select units from these stratum based on their population. Five (5) respondents were selected from big size stalls, fifteen (15) from medium size stalls and ten (10) from the small size stalls. Here, big size stall was used to mean a conversion of three (3) or more stalls into one big stall. Medium size was used for two (2) stalls put into one and small remained just a single stall. Purposive sampling was used to select two (2) respondents from key institutions responsible for regulating the domestic wood market in Ghana, Two (2) NGOs, as well as one (1) Wood Sellers Association. The researcher believed this technique was the best method to exploit judgment of the participants' based on knowledge and experience on the theme. Twelve (12) participants from the consumer group were randomly selected based on proximity and as the researcher visit them. Of these twelve participants, three (3) each were picked from the user categories as highlighted in (table 2).

Sample size

Different authors/literature employ different approaches for determining the sample size of a qualitative research. Morse (1994) recommends that 30 - 50 participants is enough to collect a large volume of data in a qualitative analysis. In total fifty-seven (57) participants across the four target group were sampled to obtained primary data for the study.

Table 2: Distribution of Respondents selected to obtained primary data for the study.

Unit of analysis	Specific unit	Sample size	Data gathering techniques
Wood producer	Formal sawmills (big)	7	Questionnaire
	Formal sawmills (small)	3	
Wood dealers	Individual wood dealers	30	Questionnaire Observations
Wood Consumers	Carpenters	3	Questionnaire
	Carving industry	3	
	Building and construction	3	
	Furniture	3	
Key Institutions	TIDD	1	Interviews
	FSD TBI KWC WSA	1 1 1 1	
Total		**57**	

Source; Author's construct

Data collection techniques 

The study relied on the use of questionnaire, interviews and field observations to obtained data for analysis.

Questionnaire

An organized semi-structured questionnaire was used to gather related primary data from the various respondents. This follows the definition by Gillham (2008), that questionnaires are elaborate to capture all the salient points needed to achieve the study objectives. The questionnaire designed was based on the following study objectives (samples are attached in the appendix.)

i. Sources of wood for domestic use.
ii. The role of timber processing companies in meeting domestic wood supply.
iii. Current interventions to sustain the domestic wood market.
iv. The impact of wood shortage on livelihood.

Three different set of Questionnaires for the different target group (wood producer, wood dealers, and wood consumers) were designed. These were deemed ideal for collecting a range of similar information of different perspective from different players in the market and was also used as a means to validate information from the other target group to add credibility to the data.

Questionnaire for wood dealers and wood consumers comprised of four-part based on the objectives enumerated above with 4-6 questions under each theme. The questionnaire for wood producers, however, had three parts without questions on the livelihood impact. This theme was deemed unnecessary for this target group as this aspect of the questionnaire examines the contribution of wood availability on dealer's household income and its impact in the event of a wood shortage.

52 respondents from all the target group were selected and a questionnaire administered. The questionnaire was given out to the respondent who could read and understand to answer the question themselves with little assistance where necessary. Those who could not read were assisted by reading and explaining questionnaire to them. The opinion of such respondents was then recorded by the researcher. Due to the nature of the market where dealers would have to call for and bargain with buyers, the time allotted for questionnaire extended and much time was spent on the questionnaire than had already anticipated.

In order to effectively assess the various sources of wood to the domestic market and contributions of timber processing companies in sustaining wood needs, sawmill (formal) and

sawmill (informal) were used to differentiate products coming from a legal and illegal source in the questionnaire.

Sawmill (formal): was used to mean authorized timber processing companies whose business is guided by law (Also see wood producers in the study population).

Sawmill (informal): on the other hand, was used to describe individual wood producers usually one or few friends who have come together in business and normally use a chainsaw or small equipment like locally manufactured sawing machine. This type of producers have no TUC or permit to operate on any land being a reserve or off-reserve. The source of logs is mostly from illegal logging.

Interviews

An interview according to Barbie (1975) is a data collection encounter in which one person (interviewer) asks questions to another (interviewee). This may be done by telephone or face to face. The type of interview conducted for the study was a face-to-face interview. The interview was conducted generally to obtain as much credible information as possible on the challenges and the success of various interventions undertaken to ensure a continuous wood supply that commensurates the quantity demanded in the country. Appointments were booked with the experts for interviews on agreed dates. The following individual (table 3) representing their various institutions were interviewed based on the level of knowledge as a result of the position being held. Interviews were conducted using a pre-determined interview prepared guide. This pre–determined questions were modified by the researcher as and when required in order to have a broader view on the subject understudied. Interviewees were also given the chance to talk about anything they deemed relevant to the subject area. This brought variety in the views of the respondents as they included different perspectives significant for the study. A new aspect of the domestic wood market was brought to bare through the interview and researcher acquired a detailed and substantial information from the various expert interviewed.

Table 3: Participants in the interview process as part of data collection techniques for the study.

Name of interviewee	Institution	Position	Date interviewed	Mode of interview	Contact Address
Mr. Dickson Adjei sakyi	FSD	ARM	09.04.2017	Face to face	Tel: +233 246235700 Email:sakyiba2014@gmail.com
Mr. Anthony Amamoo	TIDD	AM	26.05.2017	Face to face	Tel: +233 208142192 Email: aeshun27@yahoo.com
Mr. Gustav Adu	KWC	Project director	15.05.2017	Face to face	Tel: +233 243311579 Email:gustavadu@gmail.com
Boakye Twumasi-Ankra	TBI	Project Officer	12.05.2017	Face to face	Tel: +233 54979944 Email:twumank@yahoo.co.uk
Mohammed Kamil - Ishaaq	WSA	secretary	28.04.2017	Face to face	Tel: +233 243809329 Email:

Source: Researcher field data.

Observations

Observations were made on the field (Sokoban, Abuakwa and Ahwiaa wood markets) to observe the arrival of trucks loaded with wood and lumber destined for the market. This helped to establish the mode of wood supply as recommended in (Hansen et al. 2012). Researcher witnessed Conveying vehicle and drivers were questioned for better and further explanations on matters that were of interest to the researcher. Field observation offered the researcher the opportunity to have direct access to the conveying document on the truck to ascertain its source of supply. This affords the researcher the opportunity to also authenticate information from the respondents.

Initially, it was difficult getting information from the drivers especially in the Kwadaso market but the researcher used jovial and humility to solicit the needed information. The primary purpose for using this tool was to have a firsthand information and a deeper understanding of the wood supply chain. In general, this method helped to get an overview of the market and accessed how the market functions to sustain itself.

3.4.1. Data Sources

The study used both secondary and primary data source.

Primary data was gathered using questionnaire, field observation as well as interviews.

Secondary source (Literature reviewed)

A secondary source of data for the study was obtained from scientific publications and reports of individual's scientist and organizations. The organisations are; FAO, TROPENBOS-Ghana, Council for Scientific and Industrial Research (CRIG), Forestry Research Institute of Ghana (FORIG), Forestry Commission (FC) etc.

Data Analysis

The data was processed to extract vital information in the form of diagrams and tables. It was also used to evaluate the descriptive statistics (bar charts and pie charts). Statistical Package for Social Scientist (SPSS) and Microsoft Excel was used for data analysis.

3.5. Livelihood Impact

The livelihood of the domestic wood dealers was assessed based on the sustainable Livelihood approach (SLA) as described in (Walker et al. 2001). This approach was deemed appropriate to assess the impact of sustainable resources policies on people's way of life.

For the purpose of this study, the focus was to examined the extent to which various sustainable forest resource management initiatives and appropriate market instruments offers continuous livelihoods to the market players especially wood dealers by providing continuous wood supply to the domestic market with respect to some of the SLA components as referred to in (Walker et al. 2001).

The importance of the domestic wood dealer's livelihood assets was analyzed through a semi-structured questionnaire. These assets helped to determine the contributions of the existence of the market to support livelihood. Some aspect of livelihood assets critically looked at includes human capital, social capital and financial capital. Physical asset in this case the market space and other infrastructure have been provided by the government therefore was not much emphasized. These assets were analyzed to determine the influence of various policies and programs for market sustenance on dealer's livelihood and coping strategy or ability to sustain livelihoods and the associated socioeconomic problem that is likely to occur in a case of wood unavailability or shortage.

Livelihood improvement and sustenance is important in sustainable forest resources management and utilization as lives of people in both cities and rural communities are directly or indirectly linked to the forest and its products.

3.6. Limitations of the study

The study aimed at finding the sources of wood supply to the domestic market especially, the portion that is coming from the timber processing companies to sustain the domestic wood market. Yet, prominence was not placed on illegal logs supply in sawmills. This is because documents ascertaining its legality or otherwise was not available for thorough assessment at the point of questionnaire administration. Also, this study was limited only to the city of Kumasi due to time and resources available.

4. RESULTS AND DISCUSSION

4.1. Introduction

The responses (primary data) were processed and analyzed based on study objectives, field observations made and relevant related literature gathered. Results were presented and discussed in a form of tables, graphs and figures in line with the study objectives and available literature to provide/show the current wood supply chain and the impact on livelihoods on wood dealers as a result of wood shortage. The wood suppliers as the first target groups were assessed to gives an overall description of the wood supply source to feed the domestic market. The suppliers were grouped into two based on their scale of operations. The idea was to have a clearer understanding in order to offer distinctions in their mode of supply. Discussions were done base on the main study objectives which were subsequently broken down into smaller themes to further explain the salient connections and inter-linkages to the main objective. The type and performance of selected past and existing intervention i.e. LI 1649, TUP and VPA aimed at sustaining the market were also assessed in the study to determine its long term effects on the resource base in order to ensure a continuous supply of wood to the market.

The domestic wood market likened to similar unregulated market has had its fair share of challenges concerning pricing of the lumber. However, the demand and supply forces control price in the market to the extent that scarce and highly demanded tree species get expensive with growing demand. Currently, there is no standardized price of wood especially lumber and price are determined by the ability to bargain and the willingness of dealer to reduce profit margin. There are commonly agreed price per each piece based on the species, but these prices are not strictly adhere to base on the fact that there is no legal backing to ensure compliance. Meanwhile, Ghana has a standard price for all exported wood and wood products with strict adherence which is reviewed by TIDD Guiding Selling Pricing Committee from time to time to reflect the global market condition. A. Amamoo (personal communication, May 26, 2017), believe that lack of standardized pricing in the market also aid illegal trade in the wood and its products as dealers and consumers have the flexibility of choice based on the lowest price available. Though there has been an attempt by the regulator, thus FC together with its development partners to regulate prices in the domestic market by drafting an LI to that effect, the drafted LI has not been given a parliamentary consideration and it's still at the cabinet level awaiting parliamentary approval and endorsement A. Amamoo (personal communication, May 26, 2017).

4.2. Sources of wood supply to the domestic wood market

Wood and wood products are most readily available on the domestic market depending on the quality and quantity one is looking for. Wood of first and second grades (FAS, No 1 C&S, No 11 C&S) which usually come from sawmills (formal) and are of high quality are rather not often readily available to come by.

The study identified two main sources of wood supply to the domestic wood market. These are the sawmill (formal) and sawmill (informal) which could also be referred to as legal and illegal source respectively. It was identified that only 16.7% of the wood in the market was from the formal sawmill (figure 14). This constitutes of wood that satisfies the domestic wood demand whilst 83% of the domestic wood supply was from the informal source. This result is in tune with Hansen et al. (2012) who concluded in a study that 80% of wood available on the domestic market was from the illegal chain saw activities.

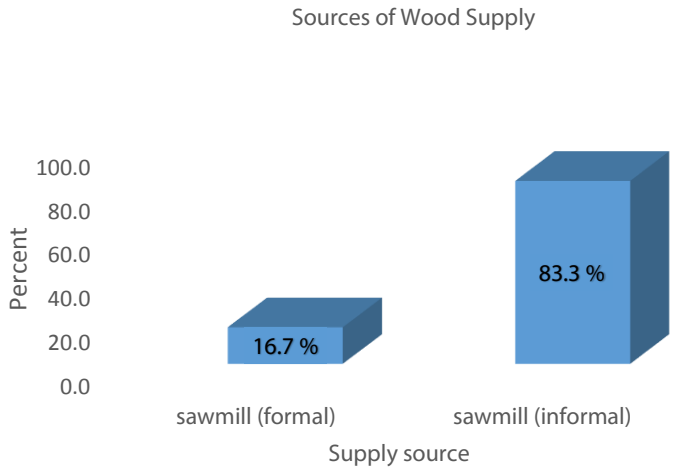

Figure 14: Two main identified sources of wood supply to the domestic market.

Source: researcher's field data

The effect of this is that legal wood supplied to the domestic market by the legal source is woefully inadequate to meet the growing demand of wood required for domestic needs. This study found out that only 16.7% of wood (lumber) on the domestic market is obtained from the formal or legal source within the study area which hosts the biggest wood marketing centre and which was also identified as the region with the highest number of wood dealers (Marfo et al. 2016). This adds up to earlier studies that, the domestic market cannot sustain itself just by relying on legal wood supply. Wood supply from timber processing companies to the domestic market was estimated to be only 28% out of the estimated 1,532.199 m^3 wood consumed monthly countrywide (Marfo et al. 2016). This is alarming given the fact that, wood consumed within the country alone as

identified by Marfo et al. (2016) translates to about 4.9 million m^3 of Round Wood Equivalent (RWE) which far exceeds the Annual Allowable Cut (AAC)[5] of 2 million m^3.

4.2.1. Sawmill-Formal (Legal source)

Sawmill plays an important part of the domestic wood demand and supply. It is the biggest single source through which legal and quality wood could be made available on the domestic market. However, over the years, the focus of the operators in formal sawmill has primarily been on the export market rather than the domestic market. This is evident as the majority of producers sampled in this study (73%) confirmed that concentration of their productions was rather on the export market neglecting the domestic market in the hands of illegal chainsaw producer (figure 15). This means that the legally sourced wood available for local consumption only constitute 27%. This is also in line with a nationwide study which put locally consumed legal wood products to 28% (Marfo et al. 2016).

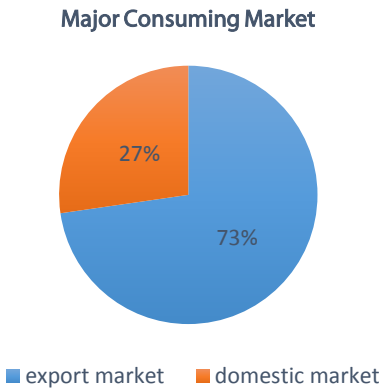

Figure 15: Graph showing the focus and directions of timber processing companies

Source: Researcher field data

Out of the ten timber processing companies selected to participate in the survey, none of them (0%) had a concession specifically earmark to produce for the domestic market. Which means that they are only mandated by law to produce 20% of the total production to the domestic market. What goes into the 20% is not specified by the law, therefore the companies rely mostly on export fall out and firewood to fulfill this mandate (figure 16). Wood that was specifically allocated and produced to the domestic market (quota allocation) accounts for only 18.2% in the survey. This complements to an earlier survey by Boampong et al.,(2015) which concluded that wood used in the furniture industry are often rejects and therefore not durable. The study identified that only 18.2% of wood is specifically selected and produced to domestic wood market. These are often tree species that has no export demand and are therefore wholly sawn to the domestic market.

[5] Permitted tree volume that could be sustainably remove annually from the natural forest

Some of these species are, however, the lesser known and use species with the lack of full knowledge on its properties and strength to withstand the harsh weather conditions (G. Adu, personal communication, May 15, 2017). This in effect contributes to forest degradation. This is because if a lesser quality species is used for product or project, its life span is not guaranteed and one would have to replace it as and when necessary. This allows for more wood to be extracted from the forest thereby contributing to degrading the remaining forest. Whereas one is sure of a longer lifespan of products and project made with high quality and known species. The most dominant product to the domestic market was from export fallout which constitutes (45.5%) followed by firewood (27.3%).

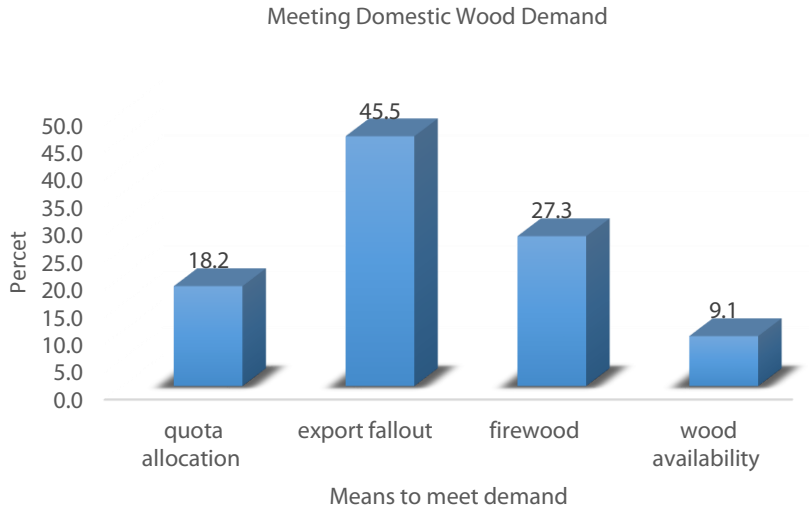

Figure 16: A graph showing the various means through which timber processing companies satisfy wood demand in the domestic market.

Source: Researchers field data.

Figures 17 shows the percentage of wood that dealers receive upon request from the formal sawmills. The results of the study showed that dealers received only 20% out of requested quantity from sawmills leaving 80% of the request unmet. The trend of supply couple with huge domestic consumption according Marfo et. al., (2016) explains why there is so much demand for chainsaw products. Twumasi-Ankra (personal communication, May 12, 2017) also echoed that the domestic wood deficit is huge and since sawmills are not able to supply enough to meet demand, it's only logical that people depend on chainsaw products to satisfied their wood needs. It is therefore vital to enforce laws and regulations concerning sustainable forest management and sustainable timber resource use to ensure an adequate supply of legal wood to the market.

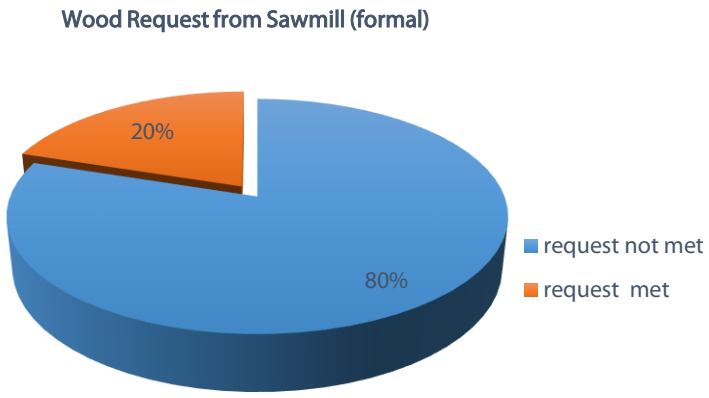

Figure 17: The quantity of wood that timber processing companies are able to supply to the domestic wood market out of quantity requested by the wood dealers.

Source: researcher's field data

The study also explored channels by which wood and wood products were supplied to the domestic market by the timber processing companies. Three main distribution/supply channels were discovered, namely; the middlemen, directly to dealers and directly to consumers.

4.2.1.1. Middlemen

Middlemen play an important role in the domestic wood supply chain especially supplies that comes from formal sawmills. Almost 82% of sawmills sampled in the study rely on the services of the middlemen to reach the domestic market. The middlemen function as wood distributors in the domestic market to make wood available to the market details shown in figure 18. Allocating wood products to the wood dealers directly has usually not been a practice in the industry. Reasons assigned by the dealer to these practices was that there exists a cordial relationship between the producer (Millers) and the middlemen and millers prefer to sell to the middlemen than selling directly to the wood market. Even though the millers can reach out to the domestic market, the engagement of these middlemen cannot be glossed over because most millers do not focus on the domestic market as their target destination for finish products hence rely on the services of these middlemen to play that role. This points out that the role of the middleman in Ghana's timber industry cannot be underestimated in supplying legal wood to the market.

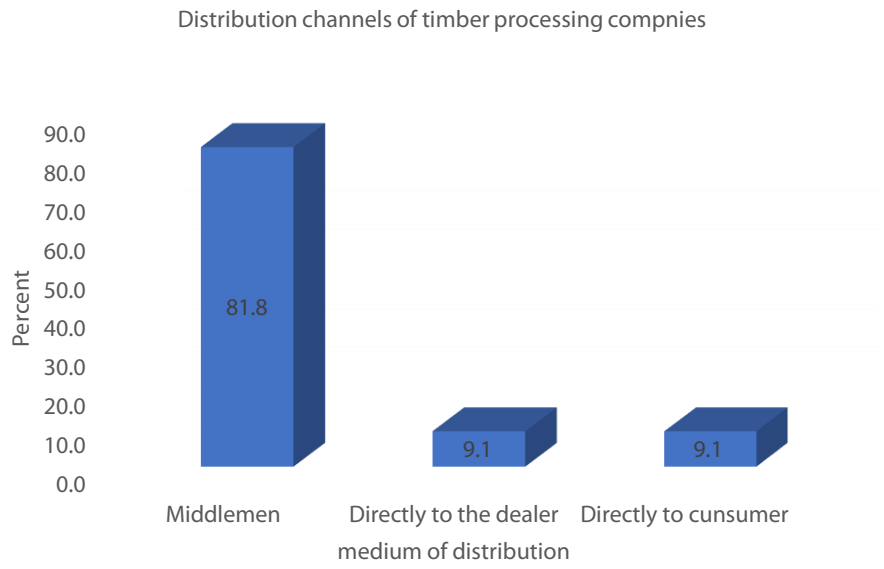

Figure 18: Distribution channel of products from sawmill (formal) to the domestic market.

Source: researcher's field data segment

Wood designated to the domestic market are sold to the middlemen for onward transfer to the domestic market making the final products very expensive to the ordinary consumer.

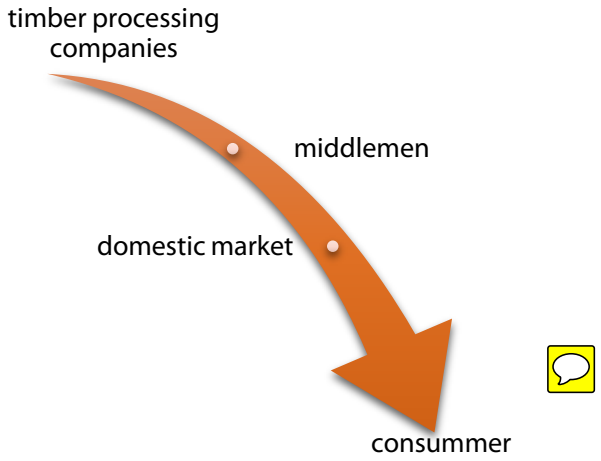

Figure 19: Distribution module of the timber processing companies in the domestic wood market.

Source: Researcher's construct

Even though the wood dealers are not fully satisfied with services of the middlemen, they are still very important factor within the market as their services cannot be ignored. Wood dealers believed that it is far better dealing with the middlemen than going to the mills themselves. Wood or lumber from sawmills is usually not directly accessible to the dealers. Some of the reasons assigned to this by the dealers being that the middlemen have established long relations with sawmills and most often, pays a huge deposit which is often monies collected from the individual

dealers weeks before products are supplied. The practice as detailed in figure 20 confirms that products are not commonly supplied to dealers on the very day payments for products were made. This creates capital lockup due to long waiting time between payment and delivery. Furthermore, products supplied were usually below the actual quantity requested and paid for.

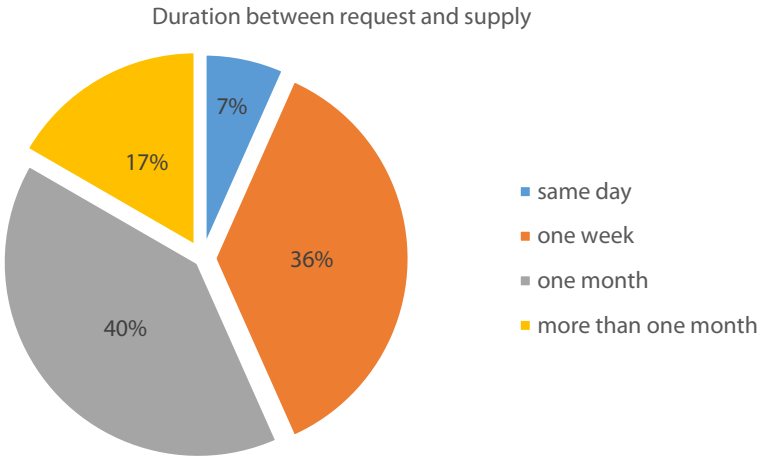

Figure 20: Graph showing the number of days within which dealers have to wait before products already paid for are supplied.

Source: Researcher's field data

The services of middlemen occur in two modules, thus between the producers and wood dealers and in some cases between the producer and consumer. In most cases, the small-scale consumers do not require middlemen to access wood. The observation made on the field showed that most of the wood consumers' especially the carpenter and the small-scale furniture outfit buy wood as and when required. Most of them do not stockpile raw material for future use. This is because products demanded cannot often be predetermined and there is also not enough money to stockpile wood whiles there is no use for them.

4.2.1.2. Directly to Wood Dealers

Results from figure 18 showed that there was a little interaction between the dealer and the producer in supplying wood and wood products to the domestic market. Out of the total wood available on the market from the timber processing companies, only 9.1% were supplied directly to the wood dealer. This is in agreement with Pinard et al. (2006) who concluded that the little supply from the timber processing companies to the domestic market is not available directly to the local retailer. Rather, supply that was available directly to the dealers was given to those who own two or more big stall and can afford to buy in bulk. Dealers confirmed this by reviewing that 88.7% of wood supplied from the timber processing companies comes through the middlemen.

What this study can infer from this is that the timber processing companies demand a huge sum of money as advance payment which is often beyond the ability of the individual wood dealer to pay. Again, the millers consider incomes from these individuals as not enough to offset their huge expenditure. This makes the middlemen who often pay in bulk a vital element in wood and lumber production and sales hence the inability of the wood dealer to conduct business without the middlemen.

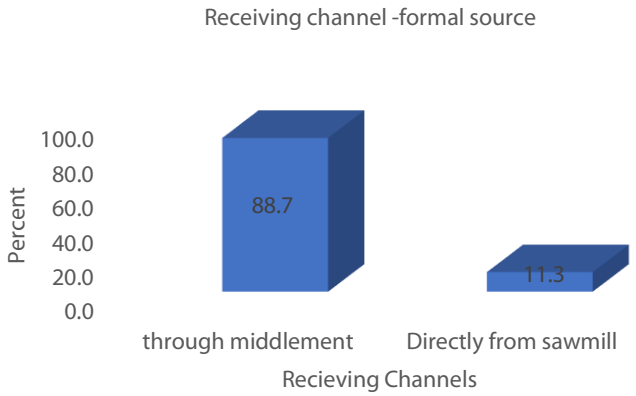

Figure 21: Receiving channel of products timber processing companies emphasizing the importance of middlemen in the domestic wood supply chain.

Source: researcher's field data

4.2.1.3. Directly to consumers

Quite often, wood and wood products are not accessible to consumers except large size building and construction companies who mostly demand in high quantities and can pay in bulk. These are multi-national companies and contractors of government projects example TRASSACO, CONSA, etc. These companies normally demand in high quantities and quality and have the ability to pay prices comparable to the export price. According to A. Amamoo (personal communication, May 26, 2017), interactions with the millers showed that they will be willing to produce quality wood in any quantity to the domestic market if prices could be adjusted to cover production and other overhead expenses. This attests why 9.1% of supplies from timber processing companies directly goes to the consumers.

Another interesting twist to this augment was a submission made by M. Kamil–Ishaaq (personal communication, April 28, 2017) who stated that due to lack of frequent supply from the timber processing companies, most of the multinational constructions companies and even contractors of government projects who are required by law to use only legal wood in all projects obtained their wood needs from the domestic market. Meanwhile, the study found that 83.3% of all wood available on the market is from an illegal source. This infers that an estimated high percentage of even government projects are made with illegal wood. B. Twumasi-Ankra, (personal

communication, May 12, 2017) assumed that government contractor patronized illegal wood because they want to maximize profits. He believed they bid for the projects based on prices of legal wood but resort to illegal wood during the actual project execution. This, the study believes is as a result of lack of monitoring and weak systems within the country.

4.2.2 Sawmill –informal (Illegal source)

The informal sawmill is the biggest supplier of wood to the domestic wood market. Most wood dealers rely on this source of illegal supply as a result of irregular supplies from the wood processing companies as describe in figure 14. The dealers believe it is wise to keep working whiles waiting for supplies from the formal sawmill in order to feed themselves and their families. An interaction with the wood dealers within the domestic market reviews that, the intent was not to willingly sell illegal products, but the unavailability to access legal wood of required quantity account for their indulgence in the sale of illegal wood.

4.2.2.1 Chain saw price

The study confirmed that wood supply from the formal sawmills was very expensive in comparison to those from the chainsaw as shown in table 4. The price difference alone is a big motivation why most dealers and consumers would want to patronize wood from this source which could also be one of the reasons why there is high demand for illegal wood in the market.

Table 4: The price difference of sawn lumber (50mm x 150mm x 4.80m) from formal and informal wood supply source to the domestic wood dealer. Prices are quoted in euro (£) with corresponding Ghana Cedis (GHc) in bracket using international exchange rate on 21.06.2017 (1£ - 4.93GHs)

species	Prices per piece of lumber sawmill-Formal in £ and (GHc)	Prices per piece of lumber from sawmill-Informal in £ and (GHc)	Difference in prices in £ and (GHc)
Dahoma	7.09 (35.00)	5.67 (28.00)	1.41 (7.00)
Esa	4.67 (23.00)	3.65 (18.00)	1.01 (5.00)
Redwood[6]	8.11 (40.00)	4.46 (22.00)	3.65 (18.00)
Chenchen	5.07 (25.00)	3.65 (18.00)	1.41 (7.00)
Otie	5.07 (25.00)	3.65 (18.00)	1.41 (7.00)

Source: Researcher field data.

The percentage of illegal wood available on the market has been accessed over the years by authors using different approach or methodologies. Different authors, reports, and researchers have quoted different figures as a percentage of wood in the domestic market coming from the

[6] This is a collective name given to species with similar characteristics and features which has the same endues.

illegal source. Hansen & Treue (2008) estimates that 70% of available wood on the market comes from the illegal source. (TIDD-FORIG 2009) came out with 76% of lumber stocks as being sourced illegally from chainsaw activities. (Hansen et al. 2012) estimated 80% of wood illegalities and a recent addition to this discourse is the current study which confirmed that 83.3% of wood on the market come from the illegal source. The trend shows that there has been a consistent increase in illegal wood that is supplied to and available on the domestic market. Wood dealers' respondents also depicted and attested to this fact that, indeed, the trend has not shown any sign of reduction as shown in figure 14. This is worrisome especially with the global outcry for sustainable in natural resource management and trade and in our quest to protect the remaining forest for posterity.

Unavailability and inadequate legal wood supply could also play a major role why people opt for illegal wood. The increasing need for domestic wood and wood product consumption is not surprising considering that, population growth is on ascendancy which has necessitated unceasing demand for wood product for domestic use and the forest is at the risk of being converted to different land use mostly in the tropical region (Sandker et al. 2015).

Two main reasons were deduced from the study as a driving force to the high demand and consumption of illegal wood in the market.

1. Illegal wood is readily available than legal wood from the wood processing companies.
2. Wood from this source is fairly cheap compared to the legal wood which makes the end price to the consumer reasonably lower.

With a high percentage of people living in absolute poverty, it is not surprising that illegal wood which is relatively cheaper is preferred by the citizenry for various end uses.

4.2.2.2. Middlemen in informal wood supply

The results of the study also showed that middlemen are not necessarily important in the illegal (informal) wood supply chain. Wood dealers' can and are comfortable dealing directly with the producers in this sector. The result of the study showed that 60% of the dealers received supplies directly from the producers as compared to 11.3% from the formal sawmills. Only 6.7% of supplies come through middlemen.

Another interesting revelation of the study was the fact that, a whopping 33.3% of all supplies within this sector is dealer sponsored (figure 22). This means that the dealer pre-financed chainsaw producers after which the products are sold to them to defray the investment cost.

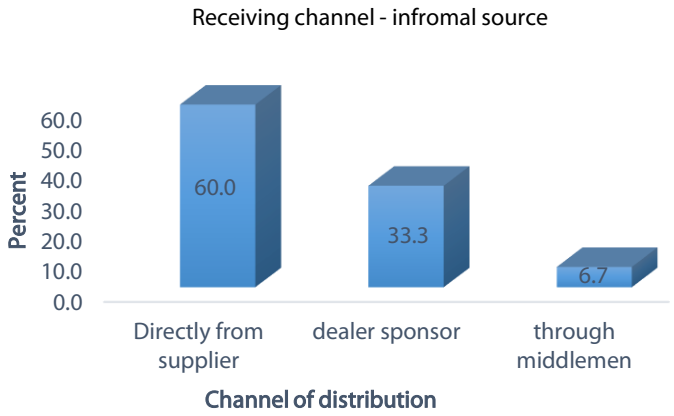

Figure 22: A graph showing how lumber and wood products reach the wood dealer in the domestic market.
Source: researcher's field data

A further interrogation into this brought to light that dealers do this in order to commit the producers to sell products to them. Most of this business is negotiated for the restricted or black star[7] species which are not supposed to be felled. Some restricted and black star species which required a special permit before they are felled are listed in table 5.

This development is very disturbing as the dealer is directly involved in the operations of the illegalities pushing local agents to scout for these species leading to the permanent destruction of both young and matures trees. The implication is that curtailing these illegal activities has now become more difficult and if care is not taking there will be the permanent extinction of these species in the near future. The dealers are motivated by the high demand for these species for domestic consumption and so.

Table 5: List of traditional premium (scarlet) and commercial (red) restricted species which the dealers mentioned as are often pre-finance in order to ensure supply.

Trade Name	Local Name	Scientific Name
African Walnut	Dubini-Biri	*Lovoa trichiloides*
Black Hyedua	Hyeduanini	*Guibourtia ehie*
Afrormosia	Kokrodua	*Pericopsis elata*
Iroko	Odum	*Milicia excelsa/regia*
Makore	Baku/Makore	*Tieghemella heckelii*
Avodire	Apapaye	*Turreanthus africanus*

Source: Researcher field data.

[7] Timber species that requires an approval of special permit issued by the Forestry Commission before they are felled.

4.2.2.3. Chainsaw Trade

Trading in chainsaw wood and wood products has been a global threat and predominantly occurs in tropical regions. Attempts by nations to control it has not been quite successful. Likening Ghana's situation to many other tropical countries, the fight against illegal chainsaw operations have not yielded desirable results and volumes of chainsaw products and wood are still traded in commercial quantities for either domestic or exported market. In Ghana, most of the chain saw products are exported to neighbouring countries (Nigeria, Burkina Faso, Niger, Mali, Senegal, and Sierra Leone) as overland export which is estimated to constitute about 44% of revenue lost from stumpage fee alone(Marfo et al. 2016).

Even though some volumes of chain saw lumber and wood are exported, most of them are consumed locally in other tropical countries. This is more prevalent in Indonesia, Democratic Republic Congo (DRC) and Peru, where all the wood consumed in the country are from the chain saw sources[8].

Fighting illegal chainsaw has been a very difficult task for Ghana because livelihoods depend on it. Out of the 120,000 job that the timber industry is estimated as being provided nationwide, Marfo & Acheampong (2011), estimate that 97,000 is provided by the chainsaw enterprise. This figure is huge making it difficult for most governments to effectively allow the appropriate institutions the free will to act in order to curb the menace for fear of losing the political goodwill of the people. This put stress on the institutions responsible for regulating forest and its products.

4.2.2.4. Farmers

The result reviewed that farmers also play an important role in the informal wood supply chain especially the raw material for the carving industry. Farmers are held in high by the carvers because they act as a reliable channel for the raw material needs. This engagement is mutually beneficial to both parties. This is important to the farmer because they earn monetary benefits whilst at the same time shady trees are removed from their farms by the carvers. A visit to the Ahyiaa Carving Centre indicated that carvers do not always rely on wood from the domestic market due to unavailability of required species and size. The domestic wood market is predominantly lumber and other wood products which are not always suitable for carving. Field observation showed a totally different wood need for the domestic wood carver (figure 24). These wood are mostly required in short logs of approximately 25 inches long.

[8] https://www.thecommonsjournal.org/articles/10.18352/ijc.327/

Figure 24: A Photo showing the different size of wood need required in the carving industry.
Source: (Adu-Agyem 2013)

Most commonly used wood species for carving as mentioned by the carvers are Sese (*Holarrhea wiufsbergii*), Twenedua (*Cordia millenii*), *Cedrela odoranta* and Sinuro (*Alstonia boonei*). These species are mostly class 2 species and are not among the highly demanded wood species internationally but have domestic demand for various end use. This has created a competition especially between the chainsaw miller and the wood carver. Field observation and interactions shows that farmers prefer to sell to the chainsaw miller because they have the ability to pay more for the trees. Carvers or their representatives that is tree hunters new have to bargain for such species which has increase the price of the trees.

Interactions and observations at the carving centre ascertained that most woods are sourced illegally except few, approximately 30% of log sellers actually sought permits from the Forest Services Division before trees are felled for such purposes. The study believed that these illegalities is as a result of the unfriendly procedures of the FSD, the distance between district forest offices and also partly defined tree tenure system within the country which allows the farmers to assumed ownership of trees occurring on his farm land.

4.3 Contributions of timber processing companies to domestic market

The importance of timber processing companies in ensuring supply of legal and quality wood to satisfy the domestic wood requirement is supreme in guaranteeing the sustainability of the domestic market. This section examined the contribution from the wood processing companies to sustain the domestic wood supply

4.3.1 Critical species for export and domestic market

The timber industry has for many years relied on known species for both export and the domestic needs. Both timber processing companies and the illegal chainsaw producers preferred the premium species, and the commercial red species first and foremost before considering any other

option. Reasons being that, these species are highly demanded in both market and therefore attract higher price which increases the profit margin. Most of these species, however, have been earmarked as restricted and therefore needs a special permit for its removal by the wood processing companies D. Adjei sakyi (personal communication, April 9, 2017). Chain saw producer, however, do not go through such process to be able to harvest such species. Therefore these species are easily available in chain sawn lumber in the domestic market than the machine sawn products. This could explain why the domestic market is highly stocked with illegal products. The trees requiring special permit has high stumpage fees and timber processing companies may not be able to break-even when these species are supplied to the domestic market.

Table 6 shows highly demanded species for lumber production in both export and domestic market. All these species are in high demand in both market however due to price differences much attention was given to the export market by the timber companies. The survey revealed that the most preferred species in the domestic market are *Piptadeniastrum africanum* (Dahoma), *Celtis mildbraedii* (Esa), *Khaya spp*. (redwoods[9]), *Triplochitin scleroxylon* (wawa) etc. as same species were also identified in Marfo et al. (2009) as most commonly stocked species in the domestic market

Almost 64% of the timber processing companies sampled confirmed that they preferred to produce to the export market than the domestic market. The price discrepancy between the two markets demanding for the same species makes it more cost-efficient for the companies to export to the detriment of the domestic market.

Table 6: highly demanded species for lumber production in both export and domestic market.

Export market	Domestic market
Triplochiton scleroxylon (Wawa)	Piptadeniastrum africanum (Dahoma)
Khaya spp (Mahogany)	*Celtis mildbraedii* (Esa)
Militia excels (Odum)	*Khaya spp*. Redwood
Entandrophragma angolense (Edinam)	*Antiaris toxicaria* (Chenchen)
Cedrella ordorata	*Triplochiton scleroxylon* (wawa)
Tieghemella heckelii (Makore)	*Pycnanthus angolense* (Otie)
Pterygota macrocarpa (Koto /Kyere)	*Terminalia superba* (Ofram)
Terminalia superba (Ofram)	*Ceiba pentandra* (Onyina)
Terminalia ivorensis (Emire)	*Cedrella ordorata*
Ceiba pentandra (Onyina)	*Pterygota macrocarpa* (koto)

[9] The "redwoods" as used in the domestic market is a collective name used to represent all the red species (Mahogany, Odum, Edinam and Makore.) as individually highlighted in the export market.

Source: Researchers field data and TIDD report Jan-Dec. 2015

4.3.2 Species availability and price

Almost all species both traditional, lesser-known species (LKS) and lesser-used species (LUS) are readily available in the domestic market. However, the ability to pay determined which species consumers use. LKS like Esa, Ceiba, Koto, etc. have gained prominence in the domestic market in terms of usage and are highly patronized and use in place of traditional species. The high patronage can be attributed to the price difference as shown in table 4. Consumers have shift preference to species which serve the same purpose but reasonably priced and these have reduced some pressure from the traditional species.

Figure 25 looks at percentage price increase of ten species in the past 2 years in the domestic wood market. Scientific data was not available so the presentation of the figure was based on estimates by dealers and consumers. From the results, there have not been major changes in the price of lumber in the domestic market within the last two years. Species that recorded major price increase (Dahoma 15%) was the preferred species for most government and donor-funded projects. Cedrella also saw an increment of 14% this apart from its high demand in the carving industry also has a high export demand and value. The increment could also be credited to the fact that the species is mostly from planted forest are therefore cannot be easily accessed like the native ones. Its unavailability makes it a bit expensive than the local and thus tend to dictate the price in the market. Ceiba also saw an increment of 11% in comparison to the other LKS (koto, esa, chenchen). This may be because the species is used for plywood production which is in high demand as overland export in the sub-region notably, Nigeria, Ivory Coast, Niger etc. Available record at TIDD shows that plywood made of Ceiba lead the overland export for 2015 and generated 13,393,253.87€ in value to the country (TIDD 2016).

The rest of the increments were not quite significant considering the rate of price increase in other commodities in Ghana. Going by the rate of demand for certain species in the export market, then, one would have thought that Redwood should have recorded major increase. Reasons for less increment could be that a very high percentage of redwood in the domestic market comes from the illegal source. This is because special permits are required by the companies to harvest it and are therefore not willing to produce it to the domestic market when there is high export demand with a good price (375€/m^3) as compared to domestic price (218€/m^3).

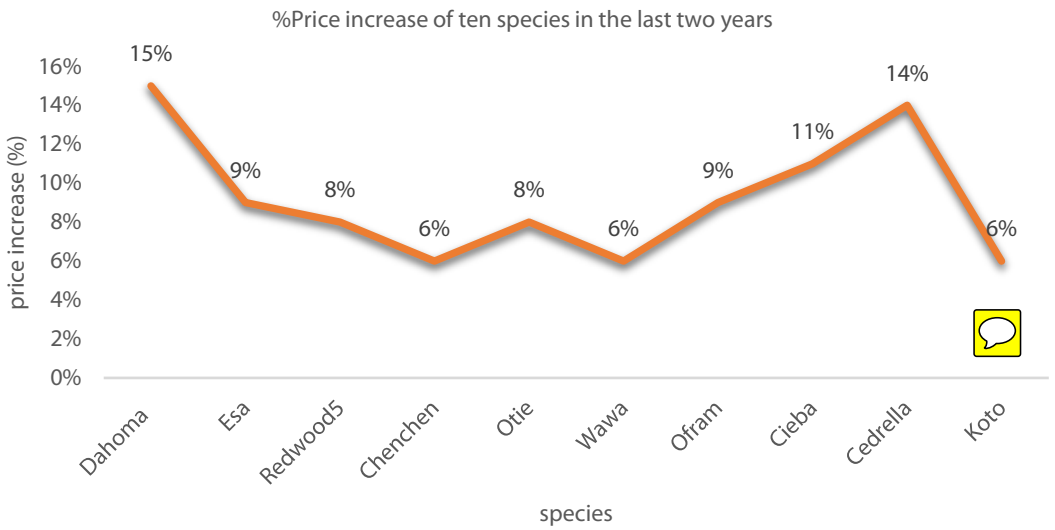

Figure 25: Price increase in the ten highly demanded species in the domestic market within the last two years.
Source: Researchers field data

4.3.2.1 Likening export price to local price

Figure 26 sums up the unwillingness of the timber processing companies to supply to the domestic market. This could be attributed to price disparity between domestic and export price of the same species. The figure revealed an interesting picture which could be an underlining factor of the timber processing mills not wanting to give out enough products to the domestic market. Even though products for the export market are high in quality, the price difference was not enticing enough to tilt production towards domestic consumption. Hansen & Lund (2011), revealed an average price difference between export and domestic lumber of all species to be USD 230 per m3.

However, the present study put the price difference between export and domestic price of same species at 35-59% which is an increase over Oteng-Amoako et al. (2008), who estimated the price difference to be about 20-40%. This difference could be as a results of almost price stagnant in the domestic market whilst export price keeps increasing apart from the fact that, the period in which the data was taken could also play a major role in the study outcome. Additionally, the trading currency mostly dollar and euro keep increasing over the past the years. A study by Hansen et al. (2012) acknowledged that wood is 47% more in the dry season than in wet season which may also influence the price in the market and affect the outcome of the study.

The price difference also underlined the need to have a price regulation mechanism in the domestic market to somehow bridge the gap to attract production into the domestic market. The

price difference alone is enough reason why companies would want to concentrate on the export market neglecting the domestic market in the hands of chainsaw producers.

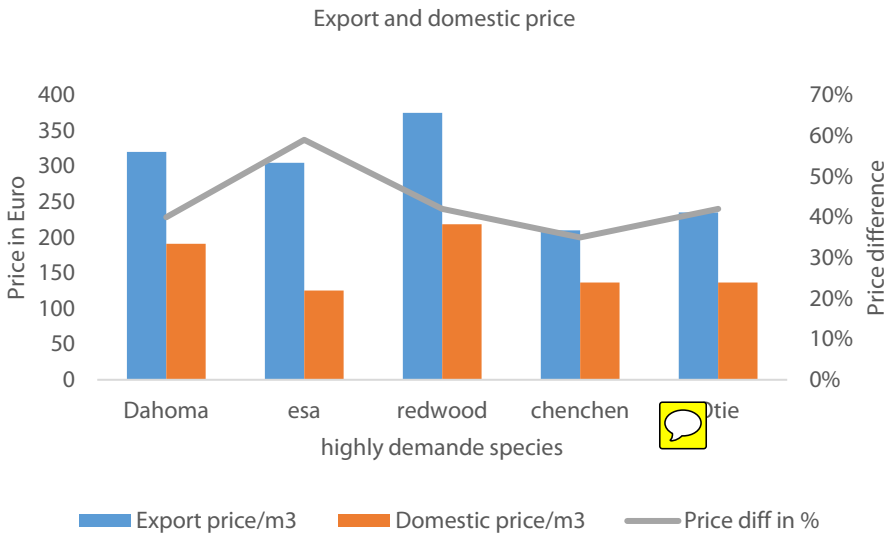

Figure 26: Graph showing the price difference between export and domestic products of the same species. prices were calculated using international exchange rate on 21.06.2017 (1£ - 4.93GHs)

Source: Researcher field data.

The companies believed that concentrating on the domestic market may not allow them to recover production cost as a result of a regular increase in energy, raw material, and labour costs. E. Amamoo (personal communication, May 26, 2017), noted that these were some of the reasons that informed the decision of TIDD to initiate domestic price control tool as various communications with the timber processing companies proved that they will be willing to produce to the domestic market at a fair price to avoid the hassle of export procedures. The companies were concerned that, some companies are inactive due to the high cost of production. This among others might account for reasons why Oteng-Amoako et al. (2008), concluded that about 70% of all timber export traded in value and in volume is shared among only 10 out of about 200 existing companies.

4.3.3 Demand Vis a Vis supply

Figure 27 shows the percentage request of the quantity of wood supplied to the domestic wood market. In most cases, a quarterly of the requested quantity (68%) is supplied. The long period between wood request and supply could also be attributed to earlier discussions of over concentration of the timber processing companies toward export market given out very little to the domestic market in a delayed manner. 73% of timber companies spoke to confirm that, 85% of production goes to the export market. The remaining 27% firms whose production is tilted

towards the domestic markets were mostly the small millers who do not have the capacity and the resource s to produce for the export market,

The result acknowledges that dealers demands of lumber from the formal sawmill are not met in terms of volume and quality. Only 7% of dealers admitted that they received all quantity requested of lumber from sawmills. This enormous gap between the demand and supply side has necessitated the prolific inflow of chainsaw products to fill the vacuum created. The sawmill, of course, is not enthused on their own to produce more to the domestic market looking at the cost of production and prevailing price. Considering monthly domestic lumber consumption of 40,230 m3, Ashanti Region alone constitutes 22% of total consumption as identified in Marfo ET. al (2016), and if only 7% of all lumber requested from the sawmills are met as discovered in this study, then, one will not be wrong from concluding that the domestic market is stocked with basically illegal wood as scientifically pointed out in this study and others (Obiri & Damnyag 2011; Hansen et al. 2012; Marfo 2010).

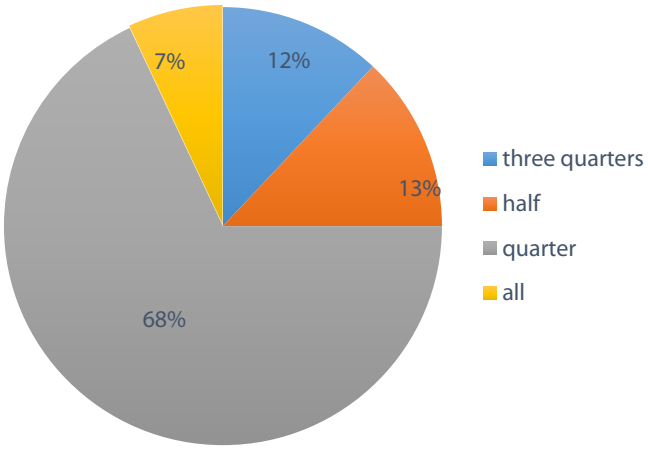

Figure 27: Quantity of wood products that timber processing companies supplied to dealers out of the quantity requested.

Source: Researcher field data.

A combination of measures is thus required to skewed production towards satisfying the domestic needs. An example will be using the appropriate market instrument and effective regulations coupled with efficient institutional and attitudinal change to move towards the supply of legal wood that will be able to withstand the growing demand in a more sustainable manner.

The study found out that dealers preferred certain dimension because it was highly demanded for various uses. This, however, depends on particular species and the required end use. For example, Dahoma which is normally used as roof trusses is often sawn in 2" x 6" x 14/16m (50mm

x 150mm x 14/16m) while Kyenkyen and Ceiba used as profile boards are sawn in 1" x 12" (25mm x 300mm x 14/16m). All the dealers surveyed preferred to sell 2" x 6" x 14/16m (100%). Dealers revealed that, this dimension was in high demand in both the building and construction, furniture as well as the carpentry industry and can be further process into smaller dimension e.g. 2" x 4" (50mm x 100mm) and 2" x 2" (50 x 50mm) which make this particular dimension fairly cheap yet highly utilizable.

Table 7: Dealer preference of wood dimensions in the domestic market.

Specification	No of respondent	Percentage of dealers
2x2	25	83.3%
2x4	28	93.3%
2x6	30	100.0%
1x9	23	76.7%
1x12	17	56.7%

Source: Researcher field data.

Different types of wood products exist on the market but the selling of lumber is the highest with about 82% of dealers' sampled engaging in the sales of only lumber and boards (photo in Appendices). This is far more than the 57% as reported in (Marfo et al. 2016). The differences could be ascribed to the sample size used. Marfo et al. covered the entire country using 44 different markets whilst the current study only concentrated in Kumasi and sampled 3 different markets.

Only 18% of dealers used in the study had additional products notably beams (picture in Appendices). This may be so because beam (picture in Appendices) is assumed on a first sight as a chainsaw product and also needs further processing before it could be used. For this reason, most processing is done at the felling sight before they are transported to the market. This notwithstanding, some were still on sale at the market while a chunk of them was found at the machinery section of the market that prompted the researcher attention for further information. It was reviewed that beams are reprocessed into various dimensions with a locally made machine which improves its appearance closer to that which is machined sawn.

About 24.4% of dealers used in the survey said they would be satisfied with 2 cargo load[10] of different species and dimension per week. Others wished their request could constitute certain dimensions of the leading species in demand.

[10] The volume of normal buckets of vehicle types Cargo truck= 41.300m3, Trailer = 59.976m3 (Marfo et al. 2016)

Table 8: Weekly needs of wood in specific dimensions by wood dealer in the domestic market

species	2x6	2x4	2x2	1x9	1x12	Quantity Needed per week	Percentage of dealers
Dahoma	✓	✓	✓			2 Cargo load	19.2
Esa	✓	✓	✓			2 Cargo load	17.8
Redwood		✓		✓	✓	2 Cargo load	13.7
Chenchen				✓	✓	1 trailer load	15.1
Otie		✓		✓	✓	1 trailer load	9.8
Mixes species & dimension	✓	✓	✓	✓	✓	2 Cargo load	24.4

Source: Researcher field data.

This study believes that the wood deficit in the domestic market is as a result of little or non-incorporation of the domestic wood needs into the timber processing company's production goals. This situation has increased the gap between the domestic wood needs and the timber companies and does not allow the needs of the domestic wood dealer to be integrated into the company's production decisions.

4.3.4 Strategies to shift production preference

The discussions so far show the unwillingness of the timber processing companies to commit to giving a substantial amount of timber products to sustain and probably increase legal wood supply on the domestic market. Interestingly, 90.9% of the producers stated that increasing the domestic lumber price close to export price will motivate them to shift attention to the domestic market (details in figure 28). The existence of the huge disparity between export and domestic price do not encourage giving out quality products of export value to the domestic market. Reasons may be that producing first-grade products for local use would keep them out of business considering the monetary input and the low priced of products in the domestic market.

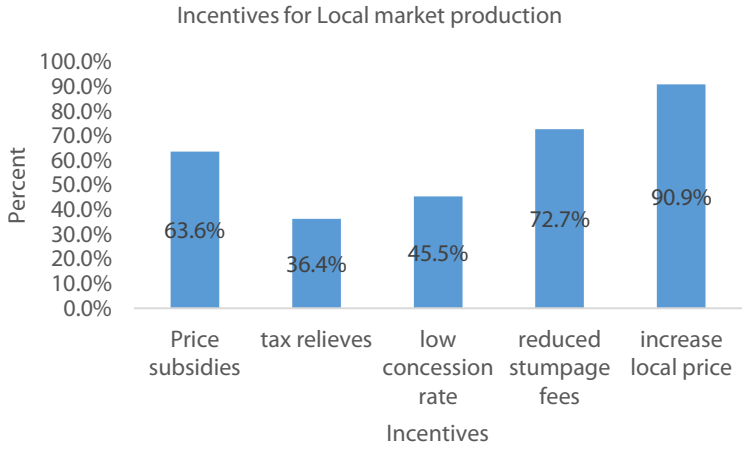

Figure 28: Incentives to induce production preference of the timber companies towards the domestic market.

Source: Researcher field data.

The figure above depicts the fight against illegal products from the market may be very difficult and far from reach. Matching domestic price with export price would increase domestic price between 35-59% as shown in figure (26) and only a few people can afford such price. Individuals and small scale wood users like the carpenters, the individual furniture makers etc. who form the majority of the consuming public may not be able to afford wood (raw material) for their work and would have no option than to rely fully on the chainsaw product which is fairly cheap and easily accessible. The gap between export and the domestic price could be a bridge by domestic price increment whilst the government subsidizes the domestic price to make wood accessible and affordable to all and sundry. It was therefore not surprising when 63.6% of the producer stated price subsidy by the government would help in increasing legal wood availability in the market. These measures may require much effort in the subsidy formulation strategy in order to reach the targeted poor and venerable group than to further enrich the big producers and retailers who are politically better connected (Baltzer & Hansen 2016). Evidence showed that government subsidies in Ghana had not been too successful and the opportunity cost of channeling public funds into subsidies is much higher in most instances (Fearon et al. 2016). Subsidizing wood price might be a short term solution whilst efforts are made to seek permanent solutions to the problem of illegal chainsaw and continuous legal wood supply to the market. This is because sustenance of such subsidy as a permanent solution may be quite difficult in a country like Ghana with less economic freedom and often lack clear-cut implementing, monitoring and exiting strategy of most sustenance programs (Baltzer & Hansen 2016).

The survey revealed that 72% would increase products to the market if government reduce the stumpage fees[11] of tree species. Interestingly, the results also revealed that even tax waiver from the government will not give enough motivation to the companies to change their production preference. Only 36% would be induced by this measure to give more of their products to the domestic market. What one can infer, therefore, is that there may be a low tax level within the timber industry which do not impact so much on the profitability of the producers (Hansen & Lund 2011). This could stem out from a number of factors including untaxed stumpage, undervalued stumpage, and institutional inefficiencies among others. Untaxed stumpage may be as a result of illegal felling of trees that are not included in the allotted yield[12] hence not counted for taxation. This could arise from institutional inefficiencies including lack of logistic and inefficient monitoring of timber harvesting operations. This could result in a large number of high valued trees that attract high stump fees exchange for lower trees with low stump fees which may

[11] Stumpage fee: Species-specific volume fee charged by FC after felling trees for economic or non-economic purposes.
[12] Species specified volumes that is sustainably allocated to companies to fell.

reduce the tax of the company thereby increasing profit margin. This challenge requires that more efficient allocation systems be devised in order to sustainably manage the remaining resources

4.4 Influence Of Government Interventions To Sustain The Domestic Market

Formulation and implementation of effective policies and strategies for efficient resource management and use are essential to sustain the natural resource base. Yet enforcement has been a problematic stemming from the commitment of stakeholders as well as the right interaction between indigenous tree tenure system and resource right which has no economic incentives to drive participation (Owubah et al. 2001). Over the years, the government of Ghana through the appropriate sectors have implemented Acts, regulations, by-laws as well as markets instruments as a tool to govern timber resource of the nation. Most of these are enshrined in the Timber Resource Management Act,1997(Act 547), with its main objectives of ensuring sustainability and use of Ghana's timber resources for now and posterity. Many provisions of the Act have been modified over time to reflect the current needs and improve adherence. The aim has been to ensure continuous legal wood supply to both export and the domestic market whilst protecting the ecological and social benefits to society.

Considering various intervention that has been put into the timber sector, one would have thought that illegality had been drastically reduced if not eliminated, yet, the current and previous studies proved that the domestic and the overland export market for the wood product is heavily choked with illegal lumber and other wood products (Odoom 2004).

This section presents a cursory overview of the successes and failure of some selected interventions implemented in order to draw lessons for future policy direction of institutional concerns.

4.4.1. Timber Resources Management Regulations, 1998 (LI 1649).

These regulations were made under the 1997 Timber Resources Management Act (Act 547) which spells out the management requirements needed in the timber sector to ensure sustainability. Section 36 of the LI 1649 recognizes the need to make provisions for domestic wood consumption and specifically mandates all TUC holders to supply timber products to the domestic market as may be determined by the appropriate authorities (Act 547). In fulfillment of this regulation, the Minister of Lands and Forestry in consultation with the Forestry Commission mandated all timber processing companies with TUC to provide 20% of total production to the domestic market as required in the LI1946. This volume was believed to be enough looking at the population size and the number of timber processing companies existed at the time. Recently, the number of timber

companies have drastically reduced w[ich] has rendered the 20% provision not enough to meet the growing demand in the domestic wood consumption. According to Colman (2004), even upon strict compliance, the mills would be able to provide only 24% of the estimated domestic consumption. TIDD-FORIG (2009) came out with 17% as a total contribution from all sawmills if this law is given total enforcement. This account for 7% reduction within 5 years between the two study which may be attributed to growth in demand and declined in the number of sawmills. It is interesting to note that, most of the figures quoted as a percentage of illegal products on the market ranges from 70-84%, which means that, indeed, the timber companies have since not complied with this legal requirement. What's more, this study found that the little that's coming from the companies were not wholly quality products and constitute only 18.2% of logs that were specifically selected and sawn for domestic consumption. The rest could be anything from firewood to sawdust.

The study also discovered that the companies do not provide to the domestic market in fulfillment of this regulation. Amazingly, only 22.8% supplied to the domestic market having this regulation in mind and in an attempt to comply with it. The rest of the 77.2% have different motivation why they would want to supply to the market. An enormous 45.4% provided to the market because there were readily market from which they could meet present financial obligations. From this outcome, one may safely conclude that the motivations were rather to access liquid cash on hand to run minor and or daily responsibilities while producing for export. About 27.3% of the companies supply to the domestic market because they would want to keep their local partners in order to stay in business. Interestingly, all the small millers were included in this category because they have no export obligations and it's, therefore, natural that products were sold to the domestic market.

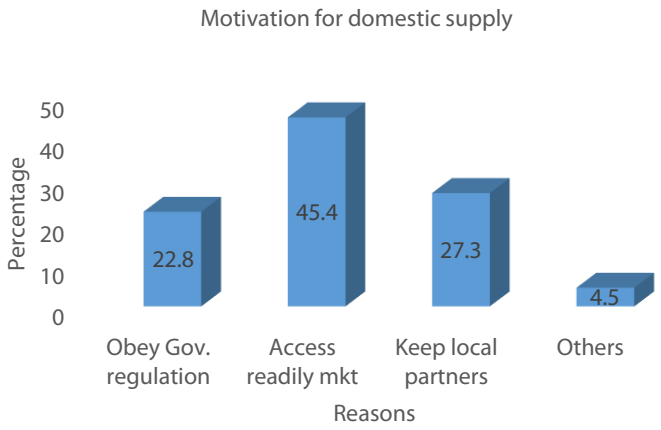

Figure 29: The reasons for timber processing companies supplying to the domestic market.

Source: Researcher field data.

This results also exposes institutional lapses in the various institutions mandated to enforce law compliance, which in this case the principal culprit may be the FC. It was however not surprising as D. Adjei sakyi (personal communication, April 9, 2017), admitted in an interview that indeed there has not been any monitoring mechanism to check compliance by the FSD. E. Amaamo (personal communication, May 26, 2017), also disclosed that his Division (TIDD) only encourages the companies to supply to the domestic market but do not have any monitoring system in place to put their production in check for this provision. Not complying with this provision may stem out from a number of reasons some of which this study believe may include;

a) that the timber companies are not even aware of this provision which is spelled out boldly in the terms of operation by the forest service division (FSD) of FC
b) that they flaw it because nobody checks them or
c) that they are not made to pay for noncompliance?

The enactment of the law (LI 1649) was with the intention to ensure an adequate supply of legal lumber and wood products to the domestic market to ensure sustainable wood supply, however, its implementation and enforcement had not been given much attention. Even though studies have concluded that the 20% is in its self not sufficient enough to meet demands, it would have contributed immensely to the available legal wood on the market and would have reduced the percentage of illegal lumber. For now, the establishment of this law has not been too successful in domestic wood supply. This might be as a result of an unwillingness to enforced compliance as identified in (Hansen and Treue 2008). Another issue is the flexibility that the LI gives to FC to set specified volume, dimensions and species. As public institutions saddled with bureaucrats principles, it is not surprising that systematic review to reflect market demand has become a problem. To be able to fully utilize this law to reap the intended purposes for which it was established requires a total adherence, enforcement, monitoring and reporting mechanism from all stakeholders.

4.4.2 Timber Utilization Permit (TUP)

Timber Utilization Permits (TUPs), finds its roots in the 1997 Timber Resources Management Act (Act 547) Section 18 (i) which permits the chief executive to make regulations suggesting circumstances for harvesting trees for social or community (mostly internal) purposes. This provision was given precision in L.I 1649 section 35 which authorized the Chief Executive Officer of the Forestry Commission to institute this type of permit upon application for social development (LI 1649). The TUP under the LI 1649 is a short-term timber right meant for domestic consumption in the area of social or community development. The purpose of this permit was

originally to access wood by district assemblies, town and rural community groups or NGOs where the timber is not for sale or exchange but used for developmental projects within its jurisdiction. Under the TUP, a limited number of trees were supposed to be harvested for projects as stated in the application documents and such permit was supposed to be outside TUC specified areas.

The existence of such provisions was meant to shift wood needs for communal projects from the domestic wood market. It was also established to encourage NGOs and philanthropist for assisting deprived town and communities with basic infrastructure like schools, clinics toilets etc. by waiving the cost of wood as the country is well endowed with these resources. The intent of this provision was excellent, nonetheless, its implementation has not been too smooth. Lund et al. (2012) found that about 124 TUPs have been granted to timber processing companies and not communities for developmental projects as the law stipulated. Furthermore, the same source confirmed that these TUPs issued covered large areas approximately 31.7km on average and do not define the number of trees to be harvested. This alone contravenes the intent of these providers within the law.

It was gathered from the study that, 30% of the timber producer's surveyed had ever been issued with TUP which dated back as far as 1999. Of these companies, 66.7% confirmed they added timber harvested from these permits to those that were meant for the export market and did not even sell product from the permit area exclusively to the domestic market which should have rather been the case at the worse instance. The rest (33.3%) stated they sold approximately 60% of the product to the domestic market and gave 40% back to the community as a fulfillment of social responsibility agreement (SRA)[13]. which was also not legal act because the SRAs is also a lawful requirement of all TUC holders to the community within which the concession is located. The agreement is mutually established by the two parties (TUC holder and the Community leaders) and the TUC holder is required to provide direct benefits from timber exploitation to the forest fringe communities as per the terms of the agreement

Distribution of lumber from TUP

[13] SRA is a legal requirements of TUC holders to commit financially into providing social amenities for forest community to also benefit from timber harvesting activities.

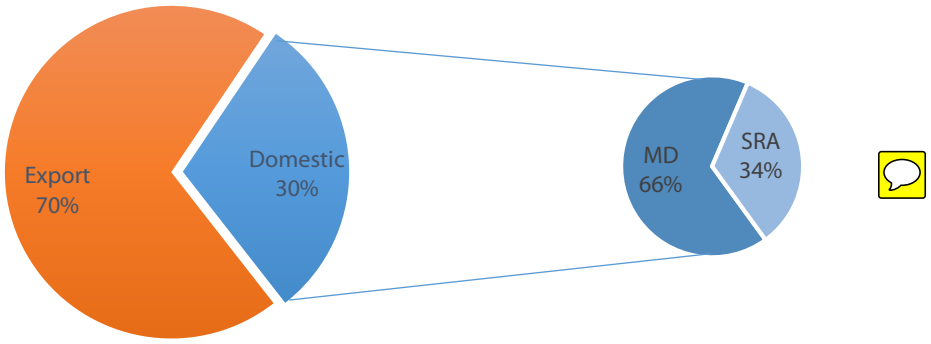

Figure 30: Distribution of wood products from TUP to timber processing companies
Source: Researcher field data.

This revelation breaches the intent of the TUP provisions within the Act and emphases the gaps within the system which confirms that most of the forest law has been legislated only and not implemented in principle. Even if they are implemented, its enforcement remains questionable as concluded in (Lund et al. 2012). The discussion above couple with other institutional lapses within the timber allocation procedure as determined by the Global witness (2013) hinders Ghana's effort of sustainable natural resource management and use.

4.4.3 Voluntary partnership agreement (VPA)

"The VPA is a bilateral agreement between the European Union (EU) and wood exporting countries" (TVD 2015). It is a legally binding trade agreement between the EU and a timber-producing country outside the EU which aim to ensure that timber products that are exported to the EU countries are legally sourced (EFI 2014). This in the view of the EU will contribute to ensuring that exported wood products into EU nations have satisfied all legal obligation of the exporting countries. As the name implies, it is voluntary, but once a country signs on to the agreement, it becomes a legally binding and the partner countries are under obligation to send only legal timber products to the EU markets.

The VPA is embedded in the action plan (Forest Law Enforcement Governance and Trade- FLEGT) of the European Union which is set out to ensure that illegal timber is excluded from the market through improved forest governance. Since its inception, six countries including Ghana have signed on to the VPA agreement and nine more are in the negotiation stage with the EU (EFI 2014). All systems necessary for the smooth running of the VPA program has been developed and Ghana is at the piloting stage and preparing for a nationwide roll out (TVD 2015).

4.4.3.1 Ghana's Motivation for VPA

Ghana was among the first countries to sign on to Voluntary Partnership Agreement (VPA) with the European Union in 2008 (Attah et al. 2011). The agreement was to provide among others, a robust system of timber utilization processes that ensure sustainability of the timber resource base and prevent environmental degradation.

Ghana signed onto the agreement primarily to protect and secure its market share in the EU countries as they were the biggest consuming nation of Ghana's wood products at the time (Acquah et al. 2014). The VPA agreement became necessary for Ghana owing to the fact that the FLEGT initiative was in line with Ghana's 1994 forest and wildlife policy (FC n.d.). The country deemed the agreement as a perfect opportunity to streamline its processes and procedures to control the high level of illegalities in the timber industry, especially illegal timber harvesting. Signing onto the VPA was, therefore, seen as a way to restructure the industry in a socially acceptable, economically beneficial and environmentally sustainable manner for both national and global benefits.

4.4.3.2 The Ghana/EU-FLEGT Arrangement

Ghana considered the EU-FLEGT arrangement as a way to utilize it timber resource in a sustainable manner whilst also securing its share in the EU market. The FLEGT arrangement was important for Ghana as it presents a total different requirement for trading in timber with EU which forces the exporting country (Ghana) to combat illegal logging at the home ground. This situation compelled Ghana to sign the agreement and join the international world in fighting illegalities in timber trade whilst protecting its resource base for posterity.

The FLEGT seeks to provide adequate law enforcement and proper governance founded on sustainable forest management in the timber industry. It also encourages timber trading established on legal and responsible practices. Since its introduction, the FLEGT has required Ghana to undergo institutional restructuring to be able to merge the existing timber laws and regulations into FLEGT/VPA requirements and prescribes processes and procedures designed to fight illegal logging in a Ghanaian context. This according to G. Adu (personal communication, May 15, 2017), will help to redefine wood production and processes strategies for better management and monitoring. He reiterated that the multi-sectoral approach and stakeholders involvement for both preparation and implementation is a laudable effort that will help in formulating standard and criteria based on sustainable foundation. The stakeholder's involvement also allows for better transparency and ownership of the process (FAO 2014).

Ghana has developed Wood Tracking System (WTS) and Legality Assurance Systems (LAS) under the VPA/FLEGHT mechanism that provides a reliable system of tracking and verifying wood products from the forest stand through to production, processing and subsequent shipment or sales at the domestic wood market (Tropenbos International 2013). This provides credence that timber products entering the EU market have been legally sourced and provides immediate information on the legal status of products with the bearing of FLEGT license or Lego.

4.4.4 Effects of Regulatory measures on domestic wood supply.

The two previously implemented measures (LI 1649 and TUP) under consideration had been practiced for decades with little successes on the actual intentions for which the regulations were envisioned to achieve.

I. LI 1649

As discussed above, this regulation was intended to order the timber companies to supply a specific quantity of lumber and wood product to the domestic market for local consumption. However, its implementation had been met with a lot of challenges stemming from a lack of enforcement, monitoring mechanism, clarity of the law itself etc. The ambiguous nature of the law gives room for speculation in its adherence. Even though the law prescribes 20% of the total output, the same law is also silent on what constitutes the 20% which gives room to the companies to decide what goes into the 20%. In an attempt to satisfy this law, the companies rely on products they could lay hands and which has no effect on export quantities. With the current need for sawdust as raw material for other industry, the companies safely include even sawdust in the count of the 20%.

This study as well as Obiri & Damnyag (2011); Hansen et al. (2012); Marfo (2010) confirms that wood supply to the domestic market is far below the actual needs of the market a. This indicates that the law has not impacted much on the wood supply to the domestic market as was intended. Even though studies had shown that full compliance with the law by the companies would have only contributed between 17-24% to the domestic wood needs of the country (TIDD-FORIG 2009; Colman 2004). This may have gone a long way in increasing legal lumber and other wood products available on the domestic market.

Although LI 1649 is quoted on the terms of the contract of the TUC, its implementation and enforcement may not have been given enough priorities by the responsible authorities as concluded in (Hansen and Treue 2008). Both regulating experts used in this study confirmed there is not enough enforcement and monitoring mechanism to ensure compliance with the law. This the study believe may be as a result of uncoordinated functions of both FSD and TIDD. FSC holds

the responsibility to regulate the harvesting of forest resources which is predominantly timber whilst TIDD is mandated to monitor the flow of wood and wood products from the forest gate through milling to export (FC-Ghana 2008). It may have been easy to enforce this law if the two division of the same institutions are well coordinated and linked automatically in their reporting system. To date, the two institutions rely on manual reporting which is cumbersome and takes too much time to report to the other institution. By the time TIDD receives harvesting report from FSD, the timber companies may have already milled the logs which make enforcement and monitoring of this law unattractive and extremely un-useful. In effect, the enactment of this law had the finest intention of making wood and wood products available for domestic needs, yet, its impact on the market may not have been positively felt due to challenges of its enforcement and monitoring. This has rendered the law ineffective and the continuous lack of legal wood available on the market has defeated the purpose for which the law was made.

II. TUP

The TUP was set up so that small permit could be granted to individuals and communities as well as philanthropist to aid in the development and to ease pressure from the domestic market. In effect, it was not to be sold but rather use for internal purposes. The intention was to make wood available to the forest fringe communities who most often own the land. Under the TUP arrangement, a farmer could apply for trees occurring on his farmland for his personal use instead of buying from the domestic market. This was to serve as a sort of compensation to the farmer for taking care of the trees especially the off-reserve areas. A motivation which would have edge them to protect and take care of the trees. The contradictory nature of some of the law of the land, in my opinion, account for the failure of this regulatory measure.

The use of chainsaw for wood conversion have been banned in the country for age[illegible] is means that, even if TUP is issued out to anybody either than the timber companies, they would have to resort to the companies for felling, hauling and possible conversion before the wood could be used for the intended purposes. This may make it unpleasant to the individuals who qualified to access this permit. The belief is that, even if this permit is issued to an individual, they are sold back to the companies due to the hassle associated with the conversion before subsequent use of the wood.

It could be assumed that most of this permits are sold to illegal timber producers since they are easily accessible and often leave in the same community. The results of this are that, even though the permit is legal, its lands in the hands of illegal producer and the final product is counted among the illegalities in the domestic market.

Farmers may also abuse this right by requesting for the permit and selling it for financial gains since there are no financial returns on the trees occurring on his farmland when the area is put under TUC. In a country like Ghana where poverty abounds especially in the farming communities, chainsaw producers who are privy to the existence of this permit may hunt for trees on farm land and encourage the farmer to apply for a permit in order to sell the right (permit) to them. All these defeat the purpose of the permit and increases illegalities in the domestic marke

III. Potential effect of VPA on Domestic Wood Market

Originally, the VPA arrangement was meant for the international market particularly timber products that are exported to the EU market. This was the main objective of the VPA initiative which Ghana signed. Ghana recognized that it will be very difficult to meet the requirement of the VPA with the current proliferation of the domestic market by illegal timber products. This obliged Ghana to include the domestic market in the terms of the VPA (EU/FLEGT Facility 2015). It is believed that the VPA initiative when implemented, can address the loop holes in timber harvesting and eliminate illegal sourcing of wood to feed the domestic market (VPA Steering Committee 2007).

A number of the initiative had been undertaken before the VPA to streamline the domestic market and reduce illegalities. Prominent among them was the total ban on the use of chainsaw for timber milling in 1998 which is recognized by the Timber Resources Management Act (Act 547). Under the VPA, both the chainsaw Miller and the chainsaw wood sellers are involved in the negotiation and consultations in finding a viable alternative to the chainsaw business. Notable among them is an introduction of Artisanal Milling (AM) led by Tropenbos Ghana. This is the use of special modern mobile milling machine (picture in appendices) intended to replace chainsaw logging and milling. Under this initiative, chainsaw producer is trained in using this machine to process timber which produces much higher yield and reduces wood waste. The new mobile machine is an improved technology to the hand chainsaw machine. The new machine is considered effective and works much faster than the chainsaw machine (B. Twumasi-Ankra, personal communication, May 12, 2017).

Under the AM model, the chainsaw miller (now artisanal miller) is also expected to be linked the to a TUC holder who will supply legal logs for processing for the domestic market (Tropenbos International Ghana 2013). This initiative according to A. Amamoo (personal communication, May 26, 2017), has the potential of producing enough lumber sourced legally to the domestic market.

M. Kamil-Ishaaq (personal communication, April 28, 2017), assumed that, when this approach is operational, illegal lumber in the domestic market would be drastically reduced. This is because

wood sellers rely on the illegal products because legal wood products are not readily available. The high recovery rate of this new machine would also help reduce the rate of deforestation when the project is rolled out to cover the entire nation. Mayers et al. (2008), however, contested that, due to the high-profit level of the chainsaw activities and the desire of Ghanaians to opt for cheap but less quality product, the VPA might not necessarily change the attitude of the chainsaw miller so much in short term. The same source nevertheless, supports the integration of chainsaw operators to TUC holders for the supply of legal log.

The involvement of both the chainsaw operators and the lumber sellers in the negotiation process of VAP brought out all fears and uncertainties which were considered and incorporated in the VPA arrangement. This has clear doubt and assured the market players of the various gains that the program stands to offer (M. Kamil-Ishaaq, personal communication, April 28, 2017). It is believed that strict adherence to VPA processes will improve local participation in forest management as indigenous people would be empowered to participate in the forest management because the VPA recognized that local livelihood depends on the forest and therefore present alternative opportunities to improve livelihoods whilst addressing illegality (D. Adjei-Sakyi, personal communication, April 9, 2017).

4.4.5 Problems facing the domestic wood market in Ghana.

The major problem facing the domestic wood market in Ghana according to the study was the lack or unavailable of legal lumber to meet demand. This challenge was widely held by all the target groups but dealers and consumers seemed more alarmed because their livelihood depends on the wood availability in the market (72%). The irony is that wood is readily available on the market but from the illegal source which makes the domestic market extremely unsustainable. Even though the government has undertaken various strategies to ensure sustainable wood supply, its impact has not been fully felt and the market still needs a proactive strategy for its sustenance. The rate of forest exploitation to sustain the domestic wood demand is great and puts the future of the timber industry at risk. This is more visible and evident in the distance that wood dealers traveled to access wood for the market. Dealers confirmed they now travel to other regions especially Western and Brong Ahafo to buy lumber for the market.

Lack of financial support was also mentioned as a problem within the sector. Dealers find it very difficult to access financial support to expand and grow their business. They assert that there is no government support in the form of the financial facility to support the domestic wood market. They believed it is also difficult to access loans from the banks due to the demand of collateral which runs into thousands of Ghana cedis.

High Transportation cost and road expenses were also a major problem facing the market. Transporting lumber to the market is very exploitative because various informal payments associated with the transportation of illegal chainsaw product. This has created an avenue for corrupt officials to extort unlawful monies from the dealers in order to transport the products. Local and districts assemblies also demand some form of payment in the form of council waybills before transportation is allowed.

All these monies are paid to individuals in order to allow for passage of chainsaw lumber to the market. This gives emphasis to the debate that the current, unregulated operations of the chainsaw sector are having a negative impact on the national economy by losing monies to individual pockets. 

4.4.6 Sustaining the domestic wood supply

To maintain a constant supply of lumber and wood products to the domestic market requires a well-managed and maintained productive resource base. It is therefore important to secure the timber resources in order to ensure continuous supply to the domestic market. A lot of measures have been proposed on the international level and adopted into the Ghanaian settings in an attempt to safely guide the natural forest for sustainable resource use.

The study tried to seek the respondent's view (timber producers) on possible sustainability standards that are being practiced on a free will or as a demand by impostors. Surprisingly, FSC was the only feasible sustainability standards that were known. Only 20% out of the companies' survey had been certified. Sadly, interactions with these companies showed that the priority of rolling onto this standard was actually not for the desire of protecting the forest, but to improve its competitive position in the market. This was due to the realization that customers in importing countries were willing to make purchasing decisions based on processes that are environmental and socially friendly. One could then argue in conformity to Russ McSpadden (2012), that there are no monitoring of companies actual practice after the FSC certificate is issued. The standard was meant to improve harvesting and production practices to lessen forest degradation and to offer continuous resource use. But its actual impact is yet to be felt in Ghanaian.

Plantation establishment was mentioned across the target group as a possible way of ensuring continuous wood supply to the domestic market. 89% and 80% of consumers and producers respectively believed that embarking on vigorous plantation of both exotic and domestic species would be the way forward for supplying enough wood to meet domestic demand as well as export needs. The dealers had the same opinions with 93% believing that tree planting is the way forward to continuously be in business. For this reason, the WSA had already been given a

degraded land at Kumawu forest district where plantation has been established since 2013 with technical assistance from the district forestry.

Apart from the establishment of plantations to support the natural forest, the dealers seem very convinced and have a strong belief in the introduction of the artisanal milling concept introduced and piloted by TBI-Ghana. This model is assumed to be a sustainable option to reduce the economic competitiveness of chainsaw lumber on the market. 72% of the wood dealers believed the concept may improve the illegal wood available on the market. The concept aimed at improving legal wood available on the domestic market by linking the chainsaw millers in the community with TUC holders for legal logs supply. The concept is seen as an ideal looking at the rate of deforestation caused by the activities of the chainsaw milling. The livelihood dependency on the chainsaw sector is also huge which necessitate for not total abolishing but proper integration into the mainstream milling in order to secure its positive benefits. The challenge of the concept is, however, the ability of the millers to purchase the milling machine (wood miser LT20) which is estimated to cost about GHc 120.000 per one. It is therefore recommended that artisanal millers form groups so that they could access credits and loans from the bank and other financial institutions to be able to afford the machines.

Most stakeholders of the timber sector have come to the realization that the traditional timber species are near extinction and therefore difficult to access. The recommendations had been to move away from these species to LKS and LUS but little success has been achieved so far. The problem is, those that were promoted are now been excessively utilized to the extent that, it may also be declared as restricted in the near future. The situation calls for more research into other species which could serve the same purpose and might be fairly cheap because of its abundance.

4.5 Contribution of domestic market in local livelihood

The unique contribution of the domestic wood market to the country's economy is vital in its developmental agenda. The sector provides livelihood support to many of the inhabitants in both cities and villages. The livelihood dependency on the domestic wood sector is huge which necessitate its sustenance. This section looks at the contribution of the existence of the domestic market to livelihood. This will further lead to a discussion on the potential and weakness of the domestic wood market.

4.5.1 Educational Backgrounds of the wood dealers (Human capital)

The human capital of the dealers used in the survey was not of the elite domain but rather compose of literate class as shown in (table 9). Most of the dealers have good educational background and that explained their level of intelligence and understanding of issues pertaining

to their line of business. The non-educated ones have been over-shadowed and the highly educated ones have been placed at the helm of affairs of the Wood Sellers Association. 30% of the human capital of the dealers sampled have had a tertiary education with different academic background which enhances their knowledge and contribution to issues that affect their business and welfare. This was given further emphasis in an interview with the two NGOs used in the survey who echoed that the contribution and demands of the wood dealers concerning sustainability measures especially the current VPA shows that, they are willing to contribute to measures that will protect their jobs and secure their livelihood.

Table 9: Educational Backgrounds of wood dealers

Level of Education	Frequency	Percentage
No Schooling	4	13.3
Junior High	7	23.3
Senior High School	10	33.3
Vocational Institutions	6	20
Degree	3	10
Total	30	100

4.5.2 Promotion of social association (Social Capital)

The existence of WSA facilitate a strong bond between the domestic wood dealers and course them to perform certain social responsibilities held in high esteemed in Ghana together. This includes showing sympathy to a bereaved family as one entity and sharing in the joy of members and close alliance of the Association e.g. customers and producers. The leaders formed the voice of the association and negotiate with central government and stakeholders on behalf of the members. It was evident in the fieldwork that the social network plays a vital role in almost everything. Interestingly this manifested in the selection of respondents as those who were chosen by the leaders to participants in the survey did so willingly. They believed in one another and fall on the other in time of need or trouble.

4.5.3 Economic contribution of the domestic market to local livelihood (Financial Capital)

About 70% of the dealers used in the survey confirmed that selling of lumber and wood products is enough to take care of their household needs. They believed that the money they make from selling alone is sufficient to meet all their needs and take care of other responsibilities of their extended dependence. This confirmed the argument by Mayers et al. (2008) who stressed that the high-profit margin by the wood dealer in selling illegal products will hinder any attempt to ceased illegalities in the market unless a very high option is given. The study also found that 53% of the dealers have no other source of income apart from the selling of lumber and other wood

products in the domestic market. Most of the other 47% who have some additional business are engaged in transport which customers hired to convey lumber or wood products from the market to their destinations. This means that, even though it's a different business, it's still highly connected to the domestic market and a break in the domestic market will also impact the other business at the initial stage before an alternative is found.

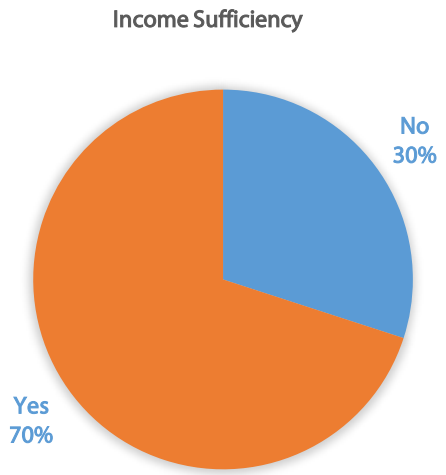

Figure 31: Assessment of income sufficiency of the domestic wood dealer to household needs.

Source: Reacher's field work

4.5.4 Socio-economic contribution of domestic market to livelihood

It is important to note that, the domestic wood market serve a significant socioeconomic purpose within the country. The extended family system practiced in Ghana has also influenced the number of people depending on the domestic wood dealer for various support. The survey revealed that 16.7% of wood dealers provide livelihood support for between 12-15 people (table 10). This may not be only biological children but includes siblings of other family members especially nephews and nieces whose daily upkeep including education depends on the dealer. 50% had 7-9 people to cater for, whilst the least number of people depending on a dealer was between 4 to 6 most of which were single and had no children of their own.

Table 10: The number of people depending on a domestic wood dealer

No of dependent	Frequency	Percentage
4-6	6	20.0
7-9	15	50.0
10-12	4	13.3
12-15	5	16.7
Total	30	100

Source: Researcher field data.

This proves that the domestic market provides livelihood support to a good number of people and cannot be ignored or wished away. The assistance to the other family members and the entire society by the wood dealer is mostly significant given the level of poverty in the country. Currently, the domestic market has taken some of the burdens which Ghana would have borne by giving employment to a high number of people in both retail of wood products and wood processing. This has helped to eliminate some of the social vices which the country would have faced in the absence of the domestic wood market. Lack or inadequate wood supply to the market may, therefore, affect a good number of people including children's education. Considering that, 70% of people selling in the domestic market can reliably take care of their household needs and dependence which the study found to be between 4 and 15 people without relying on any other source of income, then, one would agree that the domestic market is lucrative likened to other forms of business and needs to be given all the attention it deserves in order to sustain and reap the associated benefits. This result is also consistent with Obiri & Damnyag (2011) which found out more 50% of chainsaw millers earned about 97% of their household income from the illegal activity considering that about 83% of domestic wood supply comes from the chainsaw sector. This also attests to the importance of the domestic wood sector in the economy and the major role its playing in livelihood sustenance. It also indicates that livelihood contribution by the domestic market alone is enough reason to sustain it given the fact that the dealers are able to provide livelihood support to other extended family.

4.5.5 The socio-economic problems foreseen in a case of wood shortage

As discussed above, the socio-economic contribution of the domestic wood market is vital and efforts must be made to ensure continuous and sustainable wood supply to maintain these benefits. Lack or inadequate wood supply may upset the market and have impacts on other vital sectors.

4.5.5.1 Employment

Currently, there is little data showing exactly how many people are employed by the domestic wood market. However, there have been various estimates of the employment generated by the illegal chainsaw sector which is the main supply source for the domestic market. The sector has been estimated to offer employment to nearly 97,000 people in both rural communities and cities (Marfo & Acheampong 2011a). Equating these to the estimated 120.000 jobs offered by the mainstream timber industry in Ghana, one may not be wrong to conclude that the domestic wood market which is dominated by the chainsaw products offers employment to many people and can be likened employment generation by the main timber industry in Ghana.

If the furniture sector alone has the capacity to provide employment to 320,000 people Mancini (2017), it means that the Sokoban wood village which was built with the intention of providing working space for other wood dependent sectors like the carpentry and the furniture sectors can offer much more employment than it currently offering if the facility is mechanised and well-managed.

A well-managed domestic wood market gives rise to a number of secondary economic activities and has ripple effects on other unrelated sectors at both local and national level. Sectors like the transportation sector and food vendors might be direct beneficiaries of the existence of the market. It also offers menial employment to loading boys[14] and truck pushers[15] (picture in appendices) who would otherwise have been a menace to the society. Lack or inadequate supply of lumber and wood products would render lots of people unemployed and increase the unemployment rate in the country. The domestic market and the chainsaw sector together with all dependent sectors means that the domestic market employs a huge number of people and needs to be sustained so as to offer continued employment to the populace.

4.5.5.2 Revenue generation

Even though the export market attracts high taxes in comparison to the domestic market, the existence of the domestic wood market also provides revenue to the state. Emerton (2014), found that timber proceeds in Liberia's domestic market generated US$625,150 in 2008 to the state internally generated revenues. Even though there are little data as how much exactly the domestic wood market is contributing to the nation's economy, there are indications that incomes are generated from the wood market for national development. Wood dealers confirmed there are special charges in the form of taxes and tolls to the local assemblies that are used for both district and national development. Buying lumber and wood products for overland export to the neighbouring countries attract charges depending M. Kamil-Ishaaq (personal communication, April 28, 2017) on the quantity of the product. Timber retailers are required by law to register and renew their registrations annually with TIDD which attract fees that are paid to the government.

There is also Value-Added Tax (VAT) charged on lumber and products sold in the domestic market and the tax component paid to the internal revenue service at specific date (M. Kamil-Ishaaq personal communication, April 28, 2017). Same source also confirmed that individual retailers are also charged rent fees by the local assemblies for using the space for commercial activities.

[14] Boys who manually load lumber and wood products into trucks for transporting
[15] Boys who convey lumber and wood products from one place to other on a truck for a fee.

All these monies accrued from such charges contribute to the internally generated fund and are used for developmental programs.

4.5.5.3 Disintegration of social life

It has already been foreseen that the existence of domestic wood market contributes to social ties and reinforce our customs and traditions. The domestic wood market serves the raw material needs of the carving industry which mostly symbolizes the Ghanaian way of life. Some artefact depicts the traditions and customs of certain tribes which are held in high esteem by the people no matter the socio-economic class one belongs to.

Artefacts like stools (picture in appendices) are carved to denote political, traditional and religious power. In the time past, almost every home had a kitchen stool which is made of wood. Benches also made of wood were seen in community gathering centres in the town and villages for social gathering. This is gradually given way to plastic products as a result of unavailability of wood and or modernization. Wood products are becoming expensive and people are forced to substitute some of these products to the use of plastics products not as a wish, but rather due to the high price of preferred wood choice.

4.6. Key Findings

The study identified two main sources of wood supply source in the domestic market. The following diagram summarises the key findings of the study.

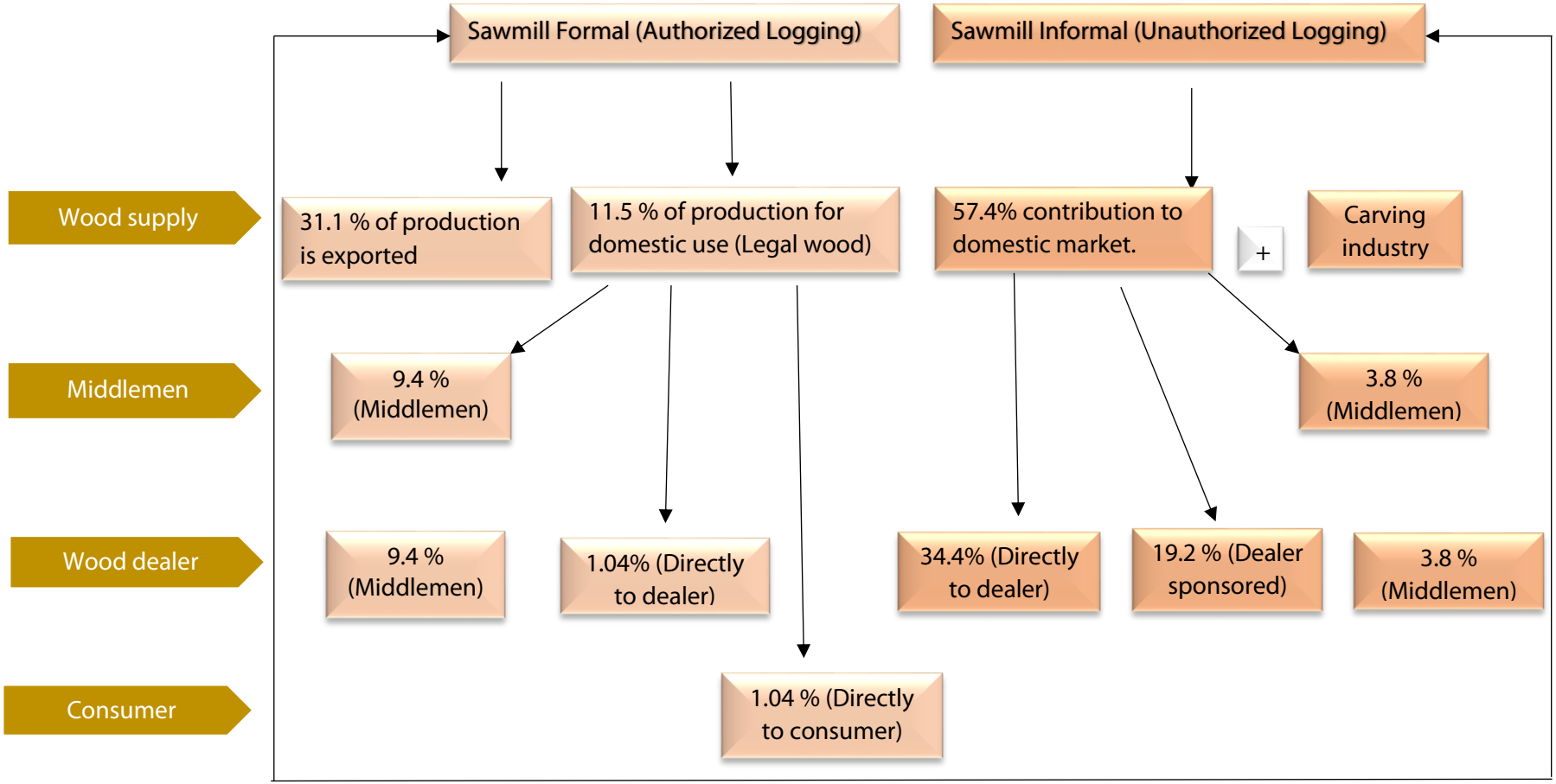

Figure 32: Wood market - quantitative distribution along the supply chain related to volumes trades.

Source: Own construct

5. CONCLUSION AND IMPLICATIONS FOR POLICY MAKERS

5.1 Rethinking the ban on illegal chainsaw in Ghana

The ban on chainsaw milling has been in existence for decades (since 1998) yet this gives enough evidence that its impacts had not been felt and the practice seems to flourish annually. The intentions of the ban which was to prevent illegal logging and onsite sawing of logs into lumber using chainsaw had ultimate aim to avoid forest degradation and or absolute deforestation. This became necessary because the activity was seen to contributing immensely to reducing the forest cover and its associated environmental benefits. However, the review of this policy by this study as evident in chapter 4.4.4 (1) showed that the ban had been unsuccessful in addressing this activity owing to a number of reasons including implementation and enforcement challenges.

The current study on the domestic wood supply had confirmed in figure 14 of this study that the wood processing companies (TUC holders) with mandates to supply to the domestic market are unable to meet the lawful requirement to provide to the domestic market owing to reasons including low lumber price in the domestic market. This has increase wood deficit in the country and the chainsaw miller had come in as a viable substitute to fulfill the domestic wood needs by producing illegal but fairly cheap lumber to the market. For now, this study confirms that the chainsaw millers are the main supplier to the domestic market holding 83.3% of domestic wood market share.

It is worthy to mention that, a lot of institutional measures had been taken by the FC to enforce this ban including the use of armed police and military task force but all to no avail (D. Adjei-Sakyi, personal communication, April 9, 2017). The practice still goes on with chainsaw products openly displayed and sold in the domestic market. This implies that the ban has totally failed in achieving the very purpose for which it was established. The implication of this is that there may be a very high percentage of revenue lost to the state. This is because the activity of the chainsaw operation is not regulated and therefore cannot be taxed or stumpage fees are not collected from these activities. This indicates that revenue lost by FC alone through illegal chainsaw in the form of unpaid stumpage runs into billions of Ghana cedis per annum since the illegal sector contributes so much to the domestic market.

With almost two (2) decades of practicing unrealistic law, the study believes it's about time for policy makers to have a second look at the law and institutes alternatives that could be more practical in its implementation and enforcement. Looking at the quantum of illegal products on the market and it associated economic and environmental loss, this study believes a possible alternative could be legalization and regularizing of chainsaw milling into the mainstream

forestry and timber industry so that terms of reference could guide the activities in an environmentally friendly manner. By this, the sector could be regulated and manage in a sustainable manner. This may save the remaining forest from total destruction and also reap all the benefits associated with the chainsaw activities in a more environmentally acceptable manner.

5.2 The missing link

The tree tenure system in Ghana which does not recognize the farmer or land owner especially in the case of off-reserve area to have economic gains from the trees occurring on farmland contributes to the ineffectiveness of the ban on chainsaw milling. The farmer who tenders and care for the trees are not given any financial benefits for these services when the area is put under TUC. Apart from compensations which arise as a result of destruction to the farm during felling and hauling of the trees. Even though FC pay royalties to the assembly, this money usually goes to the traditional authorities rather than the individual farmers. Nevertheless, the chainsaw millers pay directly to the farmer in order to have felling right of the trees. In other words, the farmer actually receives financial benefits for tendering for the trees. This money is just to have access to the trees on the farm. Farmers also receives compensations for any destruction to farm crops that might occur as a results of felling, hauling and transportation of the logs and lumber. For these reasons, farmers are rather enthused to sell trees to chainsaw millers than to wait for the area to be put under TUC without any financial benefits. This needs an urgent attention of a possible policy change which may include financial benefit to the farmer on whose land a timber tree is felled. However, it was hinted in an interview that the Ministry of Lands and Natural Resources (MLNR) has recognized this predicament and has now engaged the services of a consultant to look into the best ways to address this predicament (D. Adjei-Sakyi, personal communication, April 9, 2017).

Moreover, the inconsistency in the implementation and enforcement of forest laws also needs to be addressed. For example, whilst Act 547 gives right to individuals and communities to access timber for local use, the same law prohibits the use of a chainsaw for conversion of logs to lumber knowing very well that individuals do not have the capacity to saw logs into lumber unless with the use of chainsaw machine. If the chainsaw is prohibited what then is the use of this permit? This undermines the issuance of TUP as most individuals and communities with this permits cannot afford to engage the services of a timber processing company to saw timber into lumber for their personal use.

What is more, besides this evidence and prove that the ban on the chainsaw milling has not been effective, there is the need for institutional and political enforcement, there has been little political will of past and present government to commit to ensuring that, the law is enforced to the latter. This might be as a result of the threat of losing political votes because the sector employs quite a large number of people and livelihoods of families of all those engaged in the sectors makes it unattractive for the politician to effectively enforce this law which might displace thousands of people their livelihoods.

There is another school of thought that, the chainsaw millers are cronies and secret financiers of the two leading political parties in the country, the National Democratic Congress (NDC) and National Patriotic Party (NPP) which has been ruling the country for the past four decades. If this is anything to go by, then, it may prevent the politician to strictly enforce the law as doing so may affect their income source.

5.3 Where lies the threats

The quest for many timber producing countries especially the third world countries to shift from illegal trade in timber products has been the prime concern of most developed consuming nations. The problem of illegal logging and trade became of international concern after the realization that illegal logging is associated with substantial forest distraction with it accompanying environmental, economic and social complications.

The continued growth in demand for lumber and wood products in both the international and domestic industry has added more stress to the timber resources. This has necessitated for the overexploitation of the timber resource to satisfy the growing demands. The growth must, however, be balanced within the ecological confines of the resource base so that continuous benefits could be realized from the forest at all time.

The dependent on illegal lumber for domestic use poses a threat not only to the resource base but also to the various socio-economic and livelihood linkages. Forest value is being constantly over stretched and reduced due to stress including illegal logging activities. Water quality and biodiversity are being destroyed without recourse to the future generation owing to the fact that, there is low or lack of knowledge on appropriate felling and logging practice that reduces damages to tree sapling of valuable economic and socio-cultural species. This is alarming considering that most of the traditional hardwood in Ghana have been listed as scarlet or near extinction species.

Apart from the problems associated with illegal logging in the forest, there is also the socio-economic negative impacts of the illegal activities. The activities encourage bribery and corruption at the local and national level. Chain saw millers undermine all forestry regulations and bribe corrupt officials to have their way. The activity enriches a few people mostly the owners of the operations who abuse human right and disrespect the local communities which is against the traditions and norms of the country. This is because the illegal activities have enriched and made them powerful in the society.

This notwithstanding continues reliance on the illegal chainsaw lumber to feed the domestic wood needs poses a significant danger to the national economic development. Thousands of Ghana cedis (GHC) are being lost daily in the form of unpaid taxes and timber royalties. These monies which could have been collected and used for national development for the benefit of all are being pocketed by illegal contractors with the help of corrupt state officials.

Continuous growing in demand will require the illegal logger to produce more, this will mean much more distraction than we have already witnessed in recent times. This may destroy farm land and displaces forest fringe communities of their livelihood and other value (spiritual) of the forest in a long term.

Even though there is the positive socio-economic benefit of illegal logging, there are equally disadvantages that may outdo the benefits in a number of ways. All the benefits that are been realized from the illegalities could also be realized in a more sustainable way with adequate and feasible measures. Though efforts are under way to curtail illegal activities due to the various threat it poses to nature and human, viable options need to be provided to ensure environmental and livelihood sustenance.

5.4 The way forward

The socio-economic benefits accrued as a result of the booming domestic market as depicted by this study in chapter 4.5 for economic and social-cultural benefits needs to be harmonized with a sustainable and legal source of wood supply. This requires adequate and practical regulatory framework to be implemented and enforced for forest resource sustainability.

It is believed that securing the resource base through appropriate sustainable natural resource mechanism, effective regulations, and laws, and /or adequate market instrument will ensure continuous legal wood supply to the domestic market. This will improve local livelihood and contribute to economic development. The ripple effect of these measures will further improve Ghana's developmental agenda through foreign exchange generated from wood products

export by increasing Ghana share of wood supplied to the global wood market which currently stands at 2.2%.

The results of the study show that the sustenance of the domestic market currently depends on supply from the informal mills mostly illegal chainsaw lumber. This means that the activities of chain saw operators need to be regulated considering the important role the sector is playing in the domestic wood market. This will help to improve legal source of lumber and wood supply, sustainability of the resources, resource use efficiency, equity in resource distribution and socio-cultural benefits to the forest fringe community.

This is not to say, the conventional sawmills should be left out from supplying to the domestic market. In fact, the current domestic consumption exceeds legal wood supply which includes all export. One would argue that if there exist that huge domestic consumption why then do companies still concentrate on exports? The answer to this is not farfetched as this study confirmed that the price difference between export and the domestic product is a big motivation for producing to the export market to the disadvantage of the domestic consumption. This trend could be overturned by bridging the gap between the domestic and export price. The question here is, do the government have the will power to undertaken such decision given the political environment of the country? And is the wood consumer prepare to pay more to ensure sustainable wood supply? These may be some of the challenges that might arise in our attempt to shift production concentration from the export market to the benefits of the domestic market.

The wood processing companies cannot be totally blamed for not adhering to the 20% required of them by the timber regulation Act, and the inability to supply enough legal lumber to the domestic market. The results of the expert's interview conducted on the regulatory institutions for the study proved that there has been little attempt by these institutions (TIDD and FSD) to ensure that this regulation is enforced. This may be attributed to the policy framework itself which do not spell out directives for enforcement and monitoring mechanism.

The study believes that the discretion component within the law that allows the companies to decide what constitutes the 20% needs to be re-looked at. To some extent, they may be legally not wrong by adding firewood, saw dust, rejects and off-cuts to accounts for the required 20% considering the new and modern technologies where saw dust which used to be waste products from wood is new a raw material for some industries. Given the time and age, it will be prudent to specifically spell out what products could be included in the calculation of the 20% to the domestic market. This may improve the availability of legal lumber for domestic consumption.

To ensure full compliance of the law requires improve human resource and logistic in the institutions responsible to enforce this law. This may be influenced by politics, institutional governance, and commitment as well as supply side interventions aimed at improving high productivity by investing in modern machinery and technologies. This is particularly important as the companies rely on outmoded machinery and technologies with low recovery rate. The FC which is the main enforcement agency in this regards needs capacity building to increase monitoring and ensure total compliance of the forest laws. This will help increase legal wood available in the domestic market.

Diversification and shift from the traditionally known species which is near extinction could be encouraged by FC. There should be education on the use of innovative substitutes like bamboo and rattans as well as minor specie*s* for various end use. However, this species should be durable enough to withstand the test of time.

Lastly, both individual, WSA, private investors and the entire public need to encourage and motivate by the government, civil society, donor agencies and all stakeholders to go into plantations with technical support and inputs from the FC, FORIG, NGOs etc. This may be an opportunity to increase wood availability and to promote investment into private tree plantation for both individual and national benefits.

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APPENDICES

Appendix 1: Questionnaire for domestic wood consumer

Mary Adu-Sarpong

MSc Natural Resource Management and Development

TH-Köln University of Applied Science

Thank you for being part of this research on the topic: Analyzing the Sources of Wood Supply to Sustain Domestic Wood Demand: A Case Study of Selected Wood Markets in Kumasi-Ghana

Questionnaire for Domestic Wood Consumers

Section A. This section assess the demographic information of these focus group, the consumers of domestic wood supply. Please indicate which of the options best answer the questions. You can also decide not to answer if you think otherwise. You are also assured of the privacy of your views

1.1. Age: What is your age?

a) 18-24 years old [ ]
b) 25-34 years old [ ]
c) 35-44 years old [ ]
d) 45-54 years old [ ]
e) 55-64 years old [ ]
f) 65+ [ ]

1.2. Nationality: Please specify your nationality.

a) Ghanaian [ ]
b) Other [ ]

1.3. Education: What is the highest degree or level of school you have completed?

a) No schooling completed [ ]
b) junior high school [ ]
c) senior High school graduate [ ]
d) Professional degree [ ]
e) Bachelor's degree [ ]
f) Master's degree [ ]

1.4. Marital Status: What is your marital status?

a) Single, never married [ ]
b) Married or domestic partnership [ ]
c) Widowed [ ]
d) Divorced [ ]

e) Separated [ ]

1.5. Family: How many people constitute your household?

a) 1-3 [ ]

b) 4-6 [ ]

c) 7-9 [ ]

d) 10-12 [ ]

e) 12-15 [ ]

f) 16+ [ ]

1.6. Is your present income able to provide for your family?

a) Yes [ ]

b) No [ ]

1.7. Do you have any other source of income?

a) Yes [ ]

b) No [ ]

c)

Section B; this section assesses the sources of wood for domestic use. ***Please indicate with YES or NO the degree of your agreement or disagreement with the following statements by ticking the appropriate box.***

2.1. Where do you buy your wood from?

a) Wood market

b) Sawmill

c) Middlemen

d) All of the above

e) Others

2.2. In order of access, please indicate your main wood source (using 1to4) and the frequency of your supply using the following indicators. Every day of the week [1], every week of the month [2], every month of the year [3], every quarter of the year [4], twice a year [5], once a year [6].

Source	Frequency	Main source
Wood market		
Sawmill		
Middlemen		
Others		

2.3. In what grade?

	grade	Tick
i.	No 1 C&S	
ii.	No 2	
iii.	Export Rejects	
iv.	Firewood	

2.4. In which dimensions?

	Dimension(inches)	Tick
i.	1 x 12	
ii.	1 x 9	
iii.	2 x 6	
iv.	2 x 4	
v.	2 x 2	

Section C; this section examines why the domestic market demand is not being met. Please indicate your answer by ticking the appropriate box

3.1 How often do you buy wood?

a) Every day of the week [ ]

b) Once a week [ ]

c) Once a month [ ]

d) Once every quarter [ ]

e) As and when needed [ ]

3.3. Is wood readily available on the market?

a) Yes [ ]

b) No [ ]

3.4. If no, in your opinion, what do you think could account for this?

a) scarce raw material [ ]

b) Export-oriented industry [ ]

c) Small allocation for domestic market [ ]

d) All of the above [ ]

e) Others [ ]

3.5. Please indicate the critical species for your work and their availability on the market using the following

Availability: always available [1], moderately available [2], rarely available [3], always scarce [4]

Price: Very expensive [1], moderately expensive [2], Normal [3] comparatively low [4]

Quality: No 1 C&S [1], No 2 [2], Export Rejects [3], Firewood [4]

Price trend: Change within last 5years [1], No change within last 5years [2], always changing [3], Constant price [4].

Species	Availability	Price	Quality	Price trend

Section D; this section looks at the role of timber processing companies in meeting the domestic wood demand. Please indicate your answer by ticking the appropriate box.

4.1. Do you receive supply from sawmill?

a) Yes

b) No

4.2. How do you get your supplies from sawmill?

a) Through middlemen [ ]

b) Directly from the millers [ ]

c) Others, Specify……..……..

4.3. Are you supplied according to required specification?

a) Yes [ ]

b) No [ ]

4.4. If no, what specifications are you normally supplied of?

a) Mixed dimension [ ]

b) Export mixed cut [ ]

c) Factory rejects [ ]

d) Firewood [ ]

4.5. How long do you have to wait until your demands are supplied?

a) Same day [ ]

b) Within one week [ ]

c) Within one month [ ]

d) More than one month

4.6. Are you supplied up to the quantity demanded?

a) Yes [ ]

b) No [ ]

4.7. If no, how much do you normally received out of the quantity demanded?

a) One-third [ ]

b) Half [ ]

c) Quarter [ ]

d) Quarter < [ ]

Section E; this section examines the current interventions to sustain the domestic wood market.

1. Do you receive any support from the government or any NGO/ international aid?

   a) Yes

   b) No

2. What form of support do you get…….

…….....

3. What do you think can be done to improve the sources of wood in order to sustain your business?

……..

Appendix 2: Questionnaire for domestic wood Dealer

Mary Adu-Sarpong

MSc Natural Resource Management and Development

TH-Köln University of Applied Science

Thank you for being part of this research on the topic: Analyzing the Sources of Wood Supply to Sustain Domestic Wood Demand: A Case Study of Selected Wood Markets in Kumasi-Ghana

Questionnaire for Domestic Wood Dealers

Section A. This section assesses the demographic information of these focus group, the dealers in the domestic wood market. Please indicate which of the options best answers the questions. You can also decide not to answer if you think otherwise. You are also assured of the privacy of your views

1.1. Age: What is your age?

a) 18-24 years old [ ]
b) 25-34 years old [ ]
c) 35-44 years old [ ]
d) 45-54 years old [ ]
e) 55-64 years old [ ]
f) 65+ [ ]

1.2. Nationality: Please specify your nationality

a) Ghanaian [ ]
b) Other [ ]

1.3. Education: What is the highest degree or level of school you have completed?

a) No schooling completed [ ]
b) junior high school [ ]
a) senior High school graduate [ ]
b) Professional degree [ ]
c) Bachelor's degree [ ]
d) Master's degree [ ]

1.4. Marital Status: What is your marital status?

a) Single, never married [ ]
b) Married or domestic partnership [ ]
c) Widowed [ ]
d) Divorced [ ]

1.5. Family: How many people constitute your household?

a) 1-3 [ ]

b) 4-6 [ ]

c) 7-9 [ ]

d) 10-12 [ ]

e) 12-15 [ ]

f) 16 > [ ]

1.6. Is your present income able to provide for your family?

a) Yes [ ]

b) No [ ]

1.7. Do you have any other source of income?

a) Yes [ ]

b) No [ ]

Section B; this section assesses sources of wood supply to the domestic market. ***Please indicate the degree of your agreement or disagreement with the following statements by ticking the appropriate box.***

2.1. Where do you get your supplies from?

a) Sawmill (formal) [ ]

b) Sawmill (informal) [ ]

c) Middlemen [ ]

d) Farmers [ ]

e) Others [ ]

2.2. In order of regular supply from 5 to 1, please indicate your main sources of supply

a) Sawmill (formal) [ ]

b) Sawmill (informal) [ ]

c) Middlemen [ ]

d) Farmers [ ]

e) Others [ ]

2.3. In the table below, please specify the species, quality and quantity of supplies using 1, 2, R or F for the grade

Species	Quantity	Grade

Grades: 1= no C&S, 2= no 2, R=exports rejects, F=firewood

2.4. How often do you receive such supplies?

a) Every day of the week [ ]

b) Once a week [ ]

c) Once a month [ ]

d) Once every quarter [ ]

e) As and when needed [ ]

2.6. In order of importance from 5 to 1, which species are most demanded for domestic use?

a) Dahoma [ ]

b) Otie [ ]

c) Esa [ ]

d) Wawa [ ]

e) Redwood [ ]

2.7. Please indicate which of these species are readily available and which are non-available and the level of accessibility in your supplies. Please tick

Species	Readily available	Non-available	Drop	Increase
Dahoma				
Otie				
Esa				
Wawa				
Mahogany				

Section C; this section examines why the domestic market demand is not being met. Please indicate your answer by ticking the appropriate box

3.1. Do you receive all your quantity requested of wood from sawmills?

a) Yes [ ]

b) No [ ]

3.2. If no, what is their reason of not supplying all your request?

a) Scarce raw material [ ]

b) Export-oriented [ ]

c) Small allocation for domestic market [ ]

d) Need to supply others [ ]

e) All of the above [ ]

f) Others [ ]

3.3. What are the impediments of buying from the mills?

a) High price [ ]

b) Transportation [ ]

c) Documentation [ ]

d) Accessibility [ ]

e) Others [ ]

3.4. Compare to other sources of wood supply, how do you rate sawmill price?

a) Very expensive [ ]

b) Moderately expensive [ ]

c) Normal [ ]

d) fairly cheap [ ]

e) Cheap [ ]

3.5. Is your supply source reliable to meet the market demand?

a) Yes

b) No

3.6. If no, what can be done to ensure market sustainability……..

……

…….....

Section D; this section looks at the role of timber processing companies in meeting the domestic wood demand. Please indicate your answer by ticking the appropriate box.

4.1. What is your daily/weekly demand of wood supply and how much do you get out of these from sawmill?

Species	Qty demand	Qty supply

4.2. Are you supplied according to requested specifications?

a) Yes [ ]

b) No [ ]

4.3. If no, what specification are you normally supplied of?

a) Mixed dimension [ ]

b) Export mixed cut [ ]

c) Factory rejects [ ]

d) Firewood [ ]

4.4. How long do you have to wait until your demands are supplied?

a) Same day [ ]

b) Within one week [ ]

c) Within one month [ ]

d) More than one month [ ]

4.6. How much do you normally received out of the quantity demanded?

a) Quarter [ ]

b) One-third [ ]

c) Half [ ]

d) Three quarters [ ]

Section E; this section examines the dealer's perception to sustain the domestic wood market.

Please feel free to give out your ideas.

5.1. What are the possible threats to your business?

.....

.....

5.2. Do you see any growing potentials that might positively impact on your business?

……

……

……

5.3. What do think can be done to help sustain the domestic wood supply? List three interventions

a) ……..

b)……..

c) …….

Appendix 3: Questionnaire for domestic wood Producers

Mary Adu-Sarpong

MSc Natural Resource Management and Development

TH-Köln University of Applied Science

Thank you for being part of this research on the topic: "Analyzing the Sources of Wood Supply to Sustain Domestic Wood Demand: A Case Study of Selected Wood Markets in Kumasi-Ghana"

Questionnaire for Domestic Wood Producers

Name of supplier (Optional):

Section A; this section assesses the sources of wood supply to the domestic market. ***Please indicate the degree of your agreement or disagreement with the following statements by ticking the appropriate box.***

1.1. Do you have concession specifically earmarked to produce for the domestic market?

a) Yes [ ]

b) No [ ]

1.2. Was it difficult for you to acquire your concession (s)?

a) Yes [ ]

b) No [ ]

1.3. Do you have species specifically selected and produced for the local market?

a) Yes [ ]

b) No [ ]

1.4. If yes, please list the top 5 species that you produce to the domestic market?

a) …….

b) …….

c) …….

d) …….

e) …….

1.5. Is your raw material source stable?

a) Yes

b) No

1.6. If Yes Please give reason……..

…….

If No, please give reason……

……

……

Section B; this section examine why the domestic market demand is not being met. Please indicate your answer by ticking the appropriate box

2.1. Which kind of wood consumers do you produce for?

a) Carpenters [ ]

b) Carving industry [ ]

c) Building and construction [ ]

d) Furniture [ ]

e) All of the above [ ]

f) Other, please specify……

2.2. Do you produce to their species requirement and specifications?

a) Yes [ ]

b) No [ ]

2.3 In order of demand in the domestic market please rate the following species from 1-5. Very high demand [5], High demand [4], Moderate demand [3], Less demanded [2], no demand [1]?

Wawa		Sapele	
Esa		Mahogany	
Chenchen		Odum	
Otie			
Dahoma			
Ofram			

2.4. How do you ensure that your domestic wood demand is met?

a) By quota allocation [ ]

b) By supplementing with export fallouts [ ]

c) By supplementing with firewood [ ]

d) By producing when wood is available [ ]

e) Other [ ]

2.5. Has the domestic wood price changed in the last 5 years according to species and dimension?

a) Yes [ ]

b) No [ ]

2.6. Is it worth producing to the domestic market in comparison to export?

a) Yes [ ]

b) No [ ]

2.7. Which of these would encourage you to produce more to the local market in order of importance from 5 to 1

a) Price subsidies [ ]

b) Tax relieves [ ]

c) Low concession rate [ ]

d) Reduce stumpage fees [ ]

e) Increase local price [ ]

Section C; this section looks at the role of timber processing companies in meeting the domestic wood demand. Please indicate your answer by ticking the appropriate box

3.1. Which market consumes the majority of your product?

a) International market (Export) [ ]

b) Domestics market [ ]

3.2. What is your reason for producing to the domestic market?

a) To obey government regulations [ ]

b) To recover cost of production [ ]

c) To access ready market [ ]

d) To keep local partners [ ]

e) All of the above [ ]

3.3. What proportion of your products go to the domestic market?

a) Vast majority [ ]

b) Moderate Majority [ ]

c) Majority [ ]

d) Less [ ]

3.4. In which dimension and grade. Please indicate by ticking the dimensions and using N/ R/F to indicate the grade?

	Dimension and Grade									
Species	2 x 2	Grade	2 x 4	Grade	2 x 6	Grade	1 x 9	Grade	1 x 12	Grade
Esa										
Chenchen										
Otie										
Dahoma										
Ofram										
Wawa										

N=no 2

R=exports rejects

F=firewood

3.5. How do you provide to the domestic market?

a) Through middlemen [ ]

b) Directly to the dealers [ ]

c) Directly to the consumers [ ]

Section D; this section examine the current government interventions to sustain the domestic wood market. ***Please indicate the degree of your agreement or disagreement with the following statements by ticking the appropriate box.***

4.1. Do your importers require you to adhere to any sustainability measures?

a) Yes

b) No

4.2. If yes which one,

a) REDD+ [ ]

b) FSC [ ]

c) VPA [ ]

d) OTHERS [ ]

4.3. Since when have you been practising this.....

4.4. Do you receive any support from the government for doing any of the above?

a) Yes [ ]

b) No [ ]

4.5. Do you think adhering to these practices will ensure sustainable raw material base?

a) Yes [ ]

b) No [ ]

Appendix 4: Interview Guide for Institutions and NGOs

Mary Adu-Sarpong
MSc Natural Resource Management and Development
TH-Köln University of Applied Science

Thank you for being part of this research on the topic: "Analyzing the Sources of Wood Supply to Sustain Domestic Wood Demand: A Case Study of Selected Wood Markets in Kumasi-Ghana"

Interview Guide for Institutions

Overview

- What is your view on the domestic wood market in terms of size and trend?
- Do you think the domestic wood market has got a future in this community?
- What is the various wood source that feeds the domestic wood market?
- To what extent does your institution influence the market?
- Based on what you know about the domestic market, would you say it is sustainable?

Market demand

- How do you ensure that domestic wood demand is met?
- How do you monitor wood supply to the domestic market?
- Is the current domestic wood supply enough to satisfy domestic demand?
- What role does your institution play in the event of wood surplus and deficit?

Sustainable interventions

- What kind of interventions have your organisation put in place to sustain the resource base?
- In your opinion which of this intervention have a greater potential and why?
- How do you monitor these programs to ensure compliance?
- What has been the perception of the industry players about these interventions?
- Why are such interventions needed for sustainability?
- Is there any other thing you think might help to sustain the domestic wood supply?

Appendix 5: Field Pictures

Picture A: Stock of Lumber

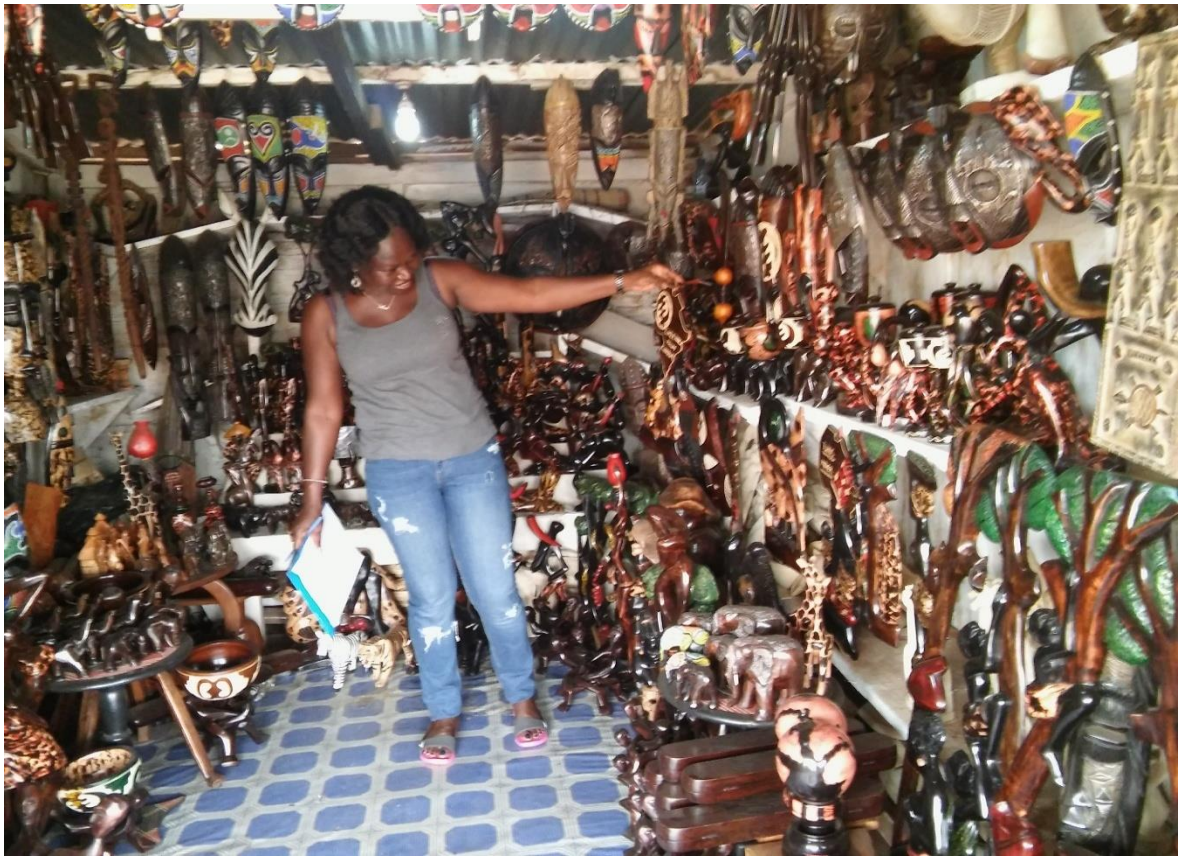
Picture B: Stock of chainsaw beam openly display in the domestic market.

Picture C: Stock of boards

Picture C: Loading boys (Loading and off-loading)

Picture C: Stool of different designs depicting various Powers

Picture C: Carved artefact of different designs and symbolic value



DECLARATION IN LIEU OF OATH

This is to confirm my Master's Thesis was independently composed/authored by myself, using solely the referred sources.

I additionally assert that this Thesis has not been part of another examination process.

Name: ADU-SARPONG, MARY

Matr. -Nr.: 11110127

Place and Date: Cologne, Germany. August 2017.

Signature